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EXPERIMENT STATION RECORD.

VOL. 35.

NOVEMBER, 1916.

No. 7.

Nothing in recent years has so emphasized and impressed the real importance of agriculture and agricultural institutions as the war in Europe. It has demonstrated dependence upon this art and has raised it to a preeminent position in the welfare of the country. Ordinarily accepted without much thought or realization by the great body of people, it has suddenly sprung into an importance second only to that of the military activities. It has become, indeed, a recognized field of war service and one of the chief elements in the national defense. Its response, and the resourcefulness and practical value which its institutions have shown, have brought the present position of agriculture close home to the people as never before on so broad a scale.

The problem of maintaining, and in some cases increasing, the production of food for man and beast has been one of the large and difficult ones in the countries at war. It has taxed their skill and organization, and their ability to cooperate in the common good. With thousands of acres devastated, relations with other countries interrupted, and with a vast army of the farmers and laborers on whom production ordinarily rests suddenly become dependent on the labor of others, the necessity of cultivating all available land and making the soil yield its full return became a national concern in all the countries. It inspired unusual measures for stimulating and assisting those who were left on the land, and led to appeals for agricultural workers second only to those for men to fight.

The way in which this extraordinary demand has been met has furnished a new realization of the great advances in every branch of farming. It has entitled agriculture to a regard and consideration which it has not always enjoyed before. If it has not actually raised it to a new position in the lives of nations, intelligent understanding of its position has been greatly broadened.

And along with the rest, this supreme test has furnished an impressive illustration of the great share which agricultural investigation, education, and various forms of instruction have had in placing agriculture on a higher plane of efficiency and in making it more resourceful and adequate. The response of agriculture is in

no small measure a reflection of the steady work of various classes of agricultural institutions and organizations, which has been going on quietly and often with meager support or understanding. The measure of strength of these agencies, and the extent to which there has been some form of agricultural organization to assist, has been a large factor in meeting the unusual situation.

The first efforts in the various countries centered largely on providing the machinery for gathering in and saving the crops, and in this the assistance of the military was furnished to a limited degree. But as time went on the necessity became apparent of providing for the continuance of agriculture on the highest possible plane, of keeping up the fertility of the land, of preventing the depletion of live stock, of avoiding waste of all kinds, and often of discovering and utilizing new sources of supplies. Organized effort was therefore enlarged and increasing latitude extended in the temporary use of soldiers.

The attitude of cooperation between the military and civil authorities is well illustrated by the instructions of the French Minister of Agriculture in transferring to district commanders the assignment of soldiers to agricultural duties. He said: "The regular, prompt, and (as far as possible) complete execution of agricultural work constitutes one of the essential elements of national resistance and consequently one of the principal forces of success. The full use of the soil must be obtained at all costs, equally with the supply of men and material to the army, or the supply of labor to factories engaged in national defense." Soldiers were classified on the basis of farm experience, and opportunity given them to offer themselves for temporary work in the fields. In order to avoid unfavorable reflection upon such, the idea was widely disseminated that soldiers thus volunteering to assist in farm work were not to be regarded as "shirkers" but on the contrary as men doing a double patriotic duty, by fighting and by keeping their brother fighters alive.

In Great Britain the measures and appeals of the government have shown no less appreciation of the importance of agricultural work. Steps were early taken to organize the agricultural forces and to increase the food production. The situation called attention to certain conditions in that country which attempts were made to remedy by a readjustment of the systems of farming, and by organizing systematic means for providing labor and increasing the food returns from the land under cultivation. In directing public attention to the need of special efforts, the president of the Board of Agriculture expressed the conviction that "if agriculture had made no more progress in Germany than it has in the United Kingdom during the period 1895-1915, the German Empire would have been at the end

of its food resources long before the second year of the war;" and he explained further that the war was being fought by that country quite as much on an agricultural as on a military organization of the nation.

In an appeal to farmers for an increase in the food production of England Lord Selborne said: "You have something more on your shoulders than your own business to-day. You are no longer individual farmers making your own fortunes or losing them. You are trustees on your own land to do your best for England. You have your duty quite as clear and as definite as the captain of a cruiser or the colonel of a battalion. England has a claim on you farmers, men and women of every class, as clear as she has on our sons and husbands to go and serve in the trenches."

The force of the situation in Great Britain is illustrated by the fact that of the total area of cultivated land, two-thirds is in permanent grass and only one-third in cultivated crops, whereas in Germany the proportion is exactly reversed; and, furthermore, by the fact that even in 1915, when the wheat crop was the largest for many years, three-fourths of the wheat supply of Great Britain had to be imported. In 1915 the United Kingdom imported agricultural products valued at £276,803,000, whereas in the year before the war France spent only £60,000,000 for imported food products.

Similarly, in Germany the need for the greatest possible production of food has been impressed upon the people. The thorough cultivation has been urged of every available piece of land on farms and in towns, and societies have been formed to take the work in hand. Efforts have been made, for example, by the Moor Culture Union to increase vegetable growing on moor land, the society announcing allowances to disabled soldiers settling on such lands.

The measures adopted by the various nations are of much interest. The French Government early applied organization to the resumption of farming in affected areas and its continuance on an efficient basis elsewhere. To save the crops the small holdings were "pooled," the inhabitants of the villages who remained being grouped together for that purpose and the assistance of the military given when circumstances allowed. The government also took measures to prevent the wholesale slaughter of live stock, first suppressing the customs duty on practically all food stuffs including frozen meat, and then excluding from requisition for army purposes cows in milk or in calf, brood mares, premium sires, pedigreed stock, heifers, and plow oxen. Similar measures were taken in Great Britain and Germany. In the districts of France that had been invaded, the peasants were in need of horses, implements, seeds, fertilizers, forage, etc. To provide these the government made advances to the peasants, and to prevent the credit banks from breaking down from demands upon them it loaned

money to the *Caisses Regionales de Credit Agricole*, which in turn advanced money to the cooperative societies. Steps were taken to increase the amount of gardening carried on, by putting the opportunity for cultivating gardens within reach of even the humblest. The services of schoolmasters were enlisted to instruct children in gardening and to carry on model gardens.

To direct these efforts a "committee of agricultural action" was formed in each commune. These committees have formed a part of the government's plan for mobilizing agricultural labor, and have also become responsible for the cultivation of farms or holdings which have fallen out of use, the supply of seeds, fertilizers, etc.

In Germany systematic provision has been made for the cultivation of the land—selecting the crops most needed, for providing fertilizers and feeds, and economy in the utilization of agricultural products. In addition to its previous agencies and its food bureau, an imperial office for vegetables and fruit, to further the production, sale, and preservation of fruit and vegetables, was established the past year, with power to provide for the growth of the necessary amount of these supplies and their preservation.

In Great Britain the organization for agriculture has been greatly extended and strengthened. War agricultural committees and borough war food societies have been organized extensively for the assistance of farmers and to secure further allotments of land for cultivation. Attention has been turned to the utilization of land not ordinarily employed in agriculture, such as private parks, golf links, pleasure grounds, etc., as well as bringing more land into cultivated crops, employment of waste woodland for raising pigs, etc.

The farmers have been urged to plow up the poorer of the permanent pastures, shorten the period of grass and clover in rotations, bring the remaining grass into the highest stage of production to enable it to carry more stock, reduce the acreage of bare fallow, and to cultivate more extensively crops for food and for animals.

The labor problem has been a difficult one in all the countries. In Great Britain persons employed in certain agricultural occupations have been exempted from military duty, but despite this, it is estimated that up to the middle of 1916, 320,000 men had been taken from the land. Special efforts have been made to secure labor at critical times, as during harvest, by a national volunteer movement, and women have been drawn into agricultural occupations as never before. In this they have shown marked adaptability and brought much favorable commendation on their services. Nearly every issue of the *Journal of the Board of Agriculture* gives accounts of the successful and satisfactory employment of volunteer women laborers, frequently drawn from classes not accustomed to outdoor work. Women's committees have been active in securing recruits, and to

overcome prejudice in some sections and convince farmers of their fitness for farm work, agricultural demonstrations have been held by women in doing various kinds of operations, such as plowing, handling teams, shearing sheep, etc.

The employment of women is even more extensive in other countries at war, and in many places the temporary employment of soldiers has been of very great assistance. The Army Council in Great Britain issued instructions the past season that as far as possible farmers be loaned draft horses, mules, and drivers for help in harvesting in the neighborhood. In Germany special attention was given this year to the prompt and proper harvesting of crops. In many cases public work of all kinds was interrupted in order to set free labor for that purpose. The extensive granting of furloughs by the military authorities contributed considerable supplies of soldier labor. In some sections the help of school children was enlisted in gathering the potato crop. France, Germany, and England to some extent, have made use of prisoners of war in carrying on farm work, the custom being to require the employer to pay a small wage for the services and provide suitable conditions for living. The results have generally surpassed expectations.

The various measures in aid of agriculture have presented fine examples of cooperation between national, state, and local agencies. There has been cooperation between the civil and military branches, supported by a realization of the necessities of each, and between governmental and private organizations, often formed voluntarily for the purpose. The strength which this union of effort has given has enabled agriculture to maintain itself under most trying conditions.

But the measures for maintaining the food supply and other necessities have not stopped with the physical means of production. They have extended to advice and direction on the side of better farming, the conservation of supplies, and the utilization of new sources. The effort has tested ingenuity and resourcefulness to an unusual degree, and in this direction has led to new demands upon the various classes of agricultural institutions. It is interesting to note especially the effect upon the activities of the experiment stations and other agencies of research.

As was natural, there has been a decrease in the kind of activity which has characterized the European stations in normal times. The product of their past work has, however, become a source of great strength and resourcefulness in the countries at war. It has been drawn upon to a hitherto unprecedented degree, even that of more theoretical character. The years of experiment and investigation and application have been realized upon in a way which has furnished renewed conviction of the practical value of such effort. Coupled

with systematic agricultural education and the various forms of instruction and advice given upon farming, it has enabled effective resistance and decreased suffering.

The forces of many of the experiment stations have been considerably depleted by the war, through drafts for field service and death, and through the diversion of their activities in other directions. A station in Austria reports that it has been turned into a hospital; others have been largely diverted to making the necessities of life, serum, war munitions, etc.; a prominent investigator in Russia writes that he is now occupied in making preserved foods for the army on a commercial scale. In general the investigation is taking more practical forms, even among men whose previous work has been especially along theoretical lines.

The director of the Rothamsted Station, writing at the close of last year, said: "The war is of course affecting us, though less than we thought it would. My young men have now practically all gone or are on the point of going, but their places are being filled by women so that the work continues. Naturally, of course, the objective has altered and the more academic problems are put on one side in order that more urgent matters can be dealt with. Much of our work now is advisory and some very interesting problems are turning up."

This advisory work and the making of tests and trials of various kinds are being participated in generally by the agricultural institutions in England and other countries. Nearly every number of the *Journal of the Board of Agriculture* contains notes on feeding stuffs, with suggested rations, prices per food unit, and similar information, supplied by the Animal Nutrition Institute of Cambridge University; advice as to sources and values of commercial fertilizers occupies a prominent place, and there are reports of numerous simple practical trials of fertilizers and feeds for immediate application. In some countries rules for the practical farmer are being worked out, and elsewhere tests made of new materials to serve as substitutes in agriculture or to replace the necessities of life in time of scarcity and high prices.

The maintenance of the industry on an efficient basis, with many of the ordinary supplies of fertilizers, feed, spraying materials, etc., diminished or cut off, has taxed the fund of knowledge and the resources of agricultural science. The high price and scarcity of copper has led to experiments to secure substitutes for copper salts in fungicides. The hot water method is being reverted to in treating seed for smut, and lime-sulphur is being given wider use. In France, unusually heavy losses were sustained from black rot in the vineyards, because of the inability to spray as much as usual.

Everywhere special stress is laid on the control of diseases and other injuries of standard crops like cereals, potatoes, beets, and

grapes, to protect the food supply. We read, also, of efforts to prevent losses other than those due to insects and plant diseases, such as the killing off of wild animals, birds, etc., which injure or feed upon farm and garden crops, and of restrictions placed on the feeding of wild game. Unusual stress is laid upon procuring good seed which will yield large returns, and special efforts have been made to provide such supplies. Plant diseases have been studied mainly from the practical side, with special reference to their control. The entomological studies have dealt largely with the relation of insects to the spread of disease.

Naturally there has been a great deal of work along food lines, with tests of various kinds of material for human food and for feeding stuffs. Yeast preparations, for example, have been devised as substitutes for meat, and found very digestible, and an egg substitute has been made from blood serum. Food preservation has taken great strides, especially desiccation by freezing or drying.

A process has been devised for preparing a cattle food from potatoes which can be kept for a long time with small loss, by fermenting small and refuse potatoes in vats by means of special cultures. To meet the need for stock feed in Germany, methods have been perfected for utilizing straw, peat, and other coarse materials by chemical means and by fermentation, reinforcing the product with dried yeast or with potato flakes and molasses. Many substitutes for oats have been devised and experimented with, among others one called chicory crumbs, made from dried chicory roots.

In veterinary lines there has been much investigation upon antiseptics to take the place of more expensive ones, sugar and salt being found effective in many cases in the treatment of animal wounds. The use of polyvalent serum, formerly used in the treatment of human wounds, has been applied to animals. Some of the institutions formerly prominent in research work have been quite extensively occupied in serum making. Considerable work in the veterinary line is reported as coming from the field service instead of the laboratory.

In Germany, there has been much activity in the fixation of atmospheric nitrogen, for general uses and for fertilizers, some marked advances having been made in the direction of efficiency and economy. Small beets, cull apples, beet residues, etc., are being employed in alcohol making; and many studies are reported on vegetable sources of oil.

The testing of farm machinery has been given special impetus on account of shortage of labor, and in some sections co-operative farm implement societies were formed to provide funds for their purchase

or joint ownership. Of late, however, some difficulties have been experienced in securing the allotment of petrol for their operation. It was announced during the past summer that the Italian Government contemplated extensive purchases of labor-saving agricultural machines, to meet the difficulties caused by lack of farm hands—a new experience in that country.

Naturally the effect on the character of the agricultural literature from abroad has been quite marked. The standard journals come less frequently and several have been suspended. Many of the research articles now published relate to work done prior to the war, rather than current investigation; and summaries of old work are common, to point out the practical application of the results. The more strictly scientific publications, especially the publications of scientific academies and the general review journals, show a much reduced size as compared with the volumes of 1913 and 1914. This is, of course, to be expected, and the wonder is, not that so relatively little but that so much new investigation is being recorded at this time.

As noted above, there is unusual activity in the direction of popular articles based on good scientific practice, results of tests of substitutes for the customary articles of food, feeding stuffs, fungicides, fertilizers, textiles, etc., immunization against disease, and advocacy of the raising of small animals for food, such as poultry, rabbits, goats, etc., the latter occupying much space. There are reports of field crops tried out to supply local deficiencies, such as oilseeds and fiber plants in Germany: new varieties developed with a view to increased production on limited areas, tests of crops in regions in which they have not previously been grown to advantage, such as sugar beets in southern France, the feeding value of various unusual or waste products, and the like.

Several standard periodicals have suspended publication, among them apparently the *Annales de l'Institut Agronomique de France* and *Annales de l'Ecole Nationale Agronomique de Montpellier*; and nearly all the Belgian literature has ceased entirely. A notable exception is the *Bulletin Agricole du Congo Belge*, published by the Belgian Ministry of Colonies, which is now being issued in London, and two numbers of a new series *Etudes de Biologie Agricole*, which have been published by this ministry.

The agricultural literature from France has considerably diminished. Practically no scientific literature has been received from Germany since June, 1916, presumably on account of difficulties of transportation. The Italian literature shows less variation from the previous subject matter than does the French, German, and English.

The official organ of the stations in that country, and also that of the Hungarian stations, has shown but little change.

Very many of the agricultural colleges and schools have felt the effects of the war. For example, in England the Royal Agricultural College at Cirencester, and the Agricultural and Horticultural College at Uckfield have been closed, and Armstrong College has been taken over as a military hospital, its agricultural department being temporarily housed in a dwelling.

Many of the French schools of agriculture had to close their doors on the outbreak of the war, but arrangements have since been made to open most of them. The national schools of agriculture at Rennes and Montpellier are being occupied by the sanitary service. A considerable number of the practical schools of agriculture and the farm schools have resumed operation, and several of these are receiving soldiers injured in the war.

In Austria twelve farm schools, thirty-five winter schools, and seven elementary forestry schools were temporarily closed on account of the war. Several minor institutions in Germany closed their doors temporarily, and the courses and attendance at the larger universities were much affected.

It is interesting to note that for the past two years the program of the British Association meetings has shown indications of the war's influence. The address of the president of the Agricultural Section last year dealt with the subject of farming and food supplies in time of war, showing the share contributed by British agriculture to the national food supply, and the extent to which it had assisted in making good the lack of supplies cut off by the war. This year the presidential address before that section was by Dr. E. J. Russell, director of the Rothamsted Station, and was on the subject of The Possibilities and Prospects of Increased Food Production.

The bulk of Dr. Russell's address was devoted to a consideration of the means of increasing the yield per acre, and of reducing the cost per acre and the uncertainties of production. He pointed to certain modifications and adaptations in the interest of larger production, notably a closer coordination of crop variety, soil and climatic conditions, increased efficiency in fertilizer treatment, and improvement in the management of barnyard manure to avoid waste. He also referred to the need of agricultural education to raise the ordinary farmer to the level of the good one, to the extension of the area of land under cultivation by the reclamation of waste, and to the substitution of arable crops for grass. The manner of treatment of the subject showed a broad grasp both of the opportunities and the means of extending production; and was typical of the liberal, scholarly study which is being given the subject at this time.

The war has gone a long way to impress upon governments and the public generally the vital position which production occupies and the advantages of the new agriculture. The supreme importance of scientific research in all branches has been impressed upon the countries of Europe by the most remarkable demonstrations ever furnished. In these demonstrations and convictions the indispensableness of science to an adequate agriculture has been given a new understanding; and in the general results the institutions and working forces charged with the prosecution of science and education in agriculture have richly shared.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Chlorophyll, G. CUSMANO (*Ann. Chim. Appl. (Rome)*, 5 (1916), No. 3-4, pp. 91-117, pl. I, fig. 1).—This is a general review of the work on chlorophyll. The subject is discussed under the following divisions: The action of alkali and acid on chlorophyll; the isolation of chlorophyll and separation into its two constituents; the carotinoids; comparison of the pigments of the leaves; and the structure of chlorophyll. A table showing the amounts of the various green and yellow coloring substances of the leaves and also one showing the decomposition products and derivatives of chlorophyll are submitted.

Bean oil (oil of *Phaseolus vulgaris*), F. WITKE (*Chem. Ztg.*, 40 (1916), No. 19-20, pp. 147, 148).—The following constants for an oil extracted by benzene from the air-dried material are submitted: Yield, 2 per cent; acid value, 17.2; saponification value, 179.2; ester value, 162; iodine value, 97.9; Hehner value, 73.2; unsaponifiable matter, 5.6 per cent; phosphorus, 0.98 per cent; lecithin, 5.6 per cent; and refractive index at 25° C., 1.4865. The fatty acids were isolated in the usual manner and yielded the following constants: Saponification value, 193.1; iodine value, 124.6; acetyl value, 52.7; acetyl acid value, 175.4; acetyl saponification value, 228.1; and refractive index at 38°, 1.4691.

The disagreement in the results obtained compared with those previously reported is briefly discussed.

The fatty oil from the seed of *Styrax japonica*, H. OKADA (*Yakugaku-zasshi (Jour. Pharm. Soc. Japan)*, No. 400 (1915), pp. 657-665).—The author obtained a yield of 45 per cent of a greenish-yellow oil with a red fluorescence from the cold-pressed seed.

The following constants were obtained for the oil: Acid value, 1.1; saponification value, 190.5; Hehner value, 94.7 per cent. The solid acids consisted of an equal mixture of stearic and palmitic acids, while the liquid acids consisted of oleic and linoleic acids. The unsaponifiable substance crystallized in glistening needles, with a melting point of 116° C.

The galactan of *Larix occidentalis*, A. W. SCHORGER and D. F. SMITH (*Jour. Indus. and Engin. Chem.*, 8 (1916), No. 6, pp. 494-499).—The authors have found that the wood of the western larch (*L. occidentalis*) contains approximately 10 per cent of a galactan not previously described. The galactan has been named ϵ -galactan. On hydrolysis it yields only galactose. The determination of galactans by oxidation to mucic acid with nitric acid according to the method of Tollens is deemed unreliable. Galactans have been shown to be characteristic of several of the common conifers.

The synthesis of acetaldehyde in fruits, H. MÜLLER-THURGAU and A. OSTENWALDER (*Landw. Jahrb. Schweiz*, 29 (1915), No. 5, pp. 508, 509).—In a study on the influence of sulphur dioxide on yeasts and bacteria in wine and fruit juices it was observed that the sulphurous acid was in some way so chemically bound as to become inactive. Further investigation showed that the sulphur dioxide was bound by the aldehydes present in the juice. Aldehyde

was found, however, only in fully ripe fruits. In pears the amount was found to increase gradually until a maximum was reached in the overripe stage of the fruit. The presence of aldehyde was only occasionally demonstrated in apples, and in one sample of grapes examined was absent.

The urease content of certain beans, with special reference to the jack bean, J. G. MATEER and E. K. MARSHALL, JR. (*Jour. Biol. Chem.*, 25 (1916), No. 2, pp. 297-305).—The authors have demonstrated that the jack bean (*Canavalia ensiformis*) contains about 15 times as much urease as the soy bean. The extract from the jack bean, however, contains much less solid residuc than the soy-bean extract. The urease appears to be specific for urea, just as is the enzym obtained from the soy bean. The use of the jack-bean urease for the rapid removal of urea from solutions in which as little contaminating material as possible should be added, and its use for quantitative urea determinations is indicated. The presence of urease was also established in the urd bean (*Phaseolus aureus*) and the horse gram (*Dolichus biflorus*).

Notes on collodion membranes for ultrafiltration and pressure dialysis, G. S. WALPOLE (*Biochem. Jour.*, 9 (1915), No. 2, pp. 284-297, figs. 5).—This article describes the preparation of collodion test-tube shaped bags and their use for simple ultrafiltration and dialysis experiments. On account of their lack of uniformity and the difficulty of accurate reproduction their use is not recommended for careful work.

Flat membranes are prepared by pouring alcohol-ether solutions of collodion on leveled plate glass and then plunging the film, after partial evaporation of the alcohol and ether, into water. With proper precautions films of remarkable uniformity can be prepared. It is suggested that "in these films, more than in other ultrafilters in general use, the channels leading through the gel structure from one side to the other are of a certain uniformity in size. None of them is large enough to allow any antigen to pass; but the structure is highly porous and, because there are many such channels, rapid ultrafiltration results."

The arrangements of apparatus in which the flat membranes and also the test-tube shaped membranes can be utilized for ultrafiltration and pressure dialysis are described in detail.

A rapid filter for turbid liquids, R. C. SHUEY (*Jour. Indus. and Engin. Chem.*, 8 (1916), No. 6, p. 523, fig. 1).—An ordinary suction filter, using the paper pulp used by distillers, and its manipulation are described.

A rapid method for comparing the decolorizing efficiency of charcoals, L. WICKENDEN and J. W. HASSLER (*Jour. Indus. and Engin. Chem.*, 8 (1916), No. 6, pp. 518, 519, fig. 1).—A method which is rapid and enables charcoals to be classified with great ease and accuracy according to their decolorizing efficiency is described. A solution of Soudan III or Oil Red RN in kerosene is used for the test. The solutions filter rapidly and come through clear and bright. The preparation of a standard scale for classifying the charcoals and also a simple colorimeter which facilitates the procedure are described.

A new colorimeter, C. F. SAMMET (*Jour. Indus. and Engin. Chem.*, 8 (1916), No. 6, pp. 519-521, fig. 1).—The author describes a colorimeter which is easily adjusted. Although designed for reading the color of turpentine, it is equally well adapted for other colorimetric work when standard glasses can be employed and the solution does not attack the metallic cell.

A Kjeldahl fume remover, F. G. MEERLE (*Jour. Indus. and Engin. Chem.*, 8 (1916), No. 6, pp. 521, 522, figs. 3).—An apparatus consisting of a lead pipe of 0.5 in. inside diameter, to which are soldered as many 3-in. lead tubes (1 in. diameter) as desired, is described. The small tubes are fitted with rubber stoppers, which are in turn fitted to the flasks used in the digestion. The acid

fumes are disposed of by passing into a sink pipe which is washed with a stream of water or in some other convenient manner.

A small apparatus for two flasks is also described.

Contribution to the determination of citric-acid-soluble phosphoric acid by the iron-citrate method. N. ZACHARIADES and J. CZAK (*Ztschr. Landw. Versuchsw. Österr.*, 18 (1915), No. 7, pp. 472-475).—Experimental data of the analysis of a number of slags by the iron-citrate method are submitted. From these data the authors conclude that the addition of hydrogen peroxid for the purpose of oxidizing any hydrogen-sulphid combinations is usually superfluous, especially if the odor of hydrogen sulphid is only weakly perceptible. The precipitate need not be filtered immediately, as has been previously recommended. The data submitted check very well with results obtained by the procedure of Popp.

Note on the determination of phosphorus in plant materials. A. W. CHASTIE (*Jour. Indus. and Engin. Chem.*, 8 (1916), No. 6, p. 511).—Experimental data submitted from the California Experiment Station indicate that the ignition of the sample with magnesium oxid is a quick and accurate method of oxidizing the organic material in the determination of total phosphorus. Oxidation with fuming nitric acid was found to be unsatisfactory.

Studies on the determination of sulphur as barium sulphate. P. L. BLEUMENTHAL and S. C. GUERNSEY (*Iowa Sta. Research Bul.* 26 (1915), pp. 539-556).—The purpose of the investigation reported was chiefly "to discover the magnitude and causes of the error involved in the usual method of determining total sulphur, particularly in lime-sulphur solutions; . . . to ascertain the method best adapted to estimating total sulphur . . . and to extend our knowledge of the mechanism of the reaction." The history and use of the method are reviewed and discussed in some detail.

Experimental results with potassium and sodium sulphates, showing the effect of various rates of addition of barium chlorid in definite quantity and of varying strengths at constant volume and acidity, demonstrate that there is little choice between the use of 5 and 10 per cent barium chlorid, the time of addition being slightly more important. Five per cent barium chlorid added at the rate of 5 cc. per minute was found to yield the best average results in the work at hand. Various strengths of acid were found not to influence the results to any great extent, although a low acidity was preferable (2 per cent or less).

In studying the effect of various salts on the precipitation it was found that when sodium salts were the only impurity very concordant analyses could be obtained. In the presence of calcium the results obtained did "not differ markedly from the figures obtained in the presence of other salts. The same variations occur, and again the necessity of working under exactly uniform conditions is emphasized." The presence of magnesium in general yielded high values. From a general consideration of the analytical results the authors arrive at the conclusion that "a pure precipitate of barium sulphate is not to be obtained by any ordinary precipitation method. The best values are due to a balancing of errors, and to insure uniformity of analyses the strictest attention must be given to maintaining definite and identical conditions in the system."

For accurate lime-sulphur analyses the following procedure is recommended: One aliquot is oxidized with sodium peroxid, heated, diluted, acidified, boiled, precipitated rapidly with 5 per cent barium chlorid, and filtered through a Gooch crucible after an hour's standing. A general idea of the amount of sulphur in the definite volume of solution is thus obtained. The volume of the final determination is so adjusted that each cubic centimeter will contain

about 1 mg. of barium sulphate. The final volume of the solution after precipitating the sulphate should thus be about 250 to 350 cc. After oxidizing a suitable aliquot with sodium peroxid, heating to hasten the oxidation, and acidifying, the solution should be boiled to drive out dissolved gases, exactly neutralized, and an amount of concentrated hydrochloric acid added so that the volume percentage of hydrochloric acid does not exceed 2 per cent. After diluting the acidified solution to the proper volume it is heated to boiling and precipitated hot with 20 cc. of 5 per cent barium chlorid added from a burette at the rate of from 5 to 10 cc. per minute, preferably at the slower rate. The solution should not be shaken or stirred. The beaker and contents after the precipitant has been added are set aside and allowed to stand for at least 12 hours before filtering. After filtration the precipitate is washed with cold water until free from chlorids, using a uniform quantity of wash water, 150 cc. added in 15 cc. portions usually sufficing to free a precipitate of this size from chlorids, and introducing a negligible loss due to solubility of barium sulphate.

In an attempt to increase the knowledge of the mechanism of the reaction, other precipitants for sulphur were tried. The authors conclude that they have no better explanation for the mechanism of the reaction than those offered by earlier investigators. The necessity for following a definite set of conditions in sulphur analysis is strongly emphasized.

A list of 43 references cited is appended.

The quantitative determination of the total protein and nonprotein substances of muscle. Improved technique, N. W. JANNEY (*Jour. Biol. Chem.*, 25 (1916), No. 2, pp. 177-183).—The following modified quantitative procedure is outlined:

"The fresh muscle is freed from all adherent fat and connective tissue, passed through a meat grinder, and thoroughly mixed. About 10 gm. is weighed by difference into a beaker from a weighing glass provided with a ground glass lid. Fifty cc. of 95 per cent alcohol is added and the contents of the beaker heated, with stirring, until the alcohol boils. The liquid is then decanted through an ordinary round filter of 12.5 cm. diameter, which has previously been extracted with alcohol and ether, dried, and weighed. This treatment of the protein with alcohol is once repeated.

"The coagulated muscle is next extracted in a similar manner with 400 cc. of boiling water in four portions, and then brought quantitatively on the filter. The filter is now carefully folded about the protein material, which is gently inserted into an extraction hull and extracted three hours in an ordinary Soxhlet apparatus with 95 per cent alcohol. The 95 per cent alcohol is then replaced by absolute alcohol and the extraction continued for a period of 15 hours. Care must be taken that the filter projects beyond the upper level attainable by the solvent, which must completely surround the protein. After completion of the extraction the filter with the pure protein is removed from the apparatus, dried to constant weight at 105° [C.] in a weighing glass provided with a ground glass lid, and the previously ascertained weight of the filter paper deducted."

When required, the nonprotein substances are determined by deducting the percentage of protein found from the percentage of total solids.

The protein content of muscle. N. W. JANNEY (*Jour. Biol. Chem.*, 25 (1916), No. 2, pp. 185-188).—This material has been essentially noted from another source (E. S. R., 35, p. 315).

The ninhydrin reaction with amino acids and ammonium salts. V. I. HARDING and F. H. S. WABNEFORD (*Jour. Biol. Chem.*, 25 (1916), No. 2, pp. 319-

345).—The experimental data demonstrate that ammonium salts of weak acids react positively with ninhydrin in concentrations of 1 per cent. In very high concentrations the ammonium salts of strong mineral acids give a positive ninhydrin reaction. Reducing agents increase the sensitiveness of the ninhydrin reaction with ammonium salts.

"In the presence of pyridin and in a concentration of 1 cc. = 0.05 mg. of nitrogen, all ammonium salts react positively with triketohydrindene hydrate. The amount of decomposition of the ammonium nitrogen was found to be independent of the acid radical attached and possessed a constant value of 0.018 mg. nitrogen; the blue coloration is due to the ammonium salt of diketohydrindylidene-diketohydrindamin."

A theory as to the mechanism of the reaction with amino acids and ammonium salts is suggested.

The ninhydrin reaction with amines and amides, V. J. HAMBURG and R. M. MACLEAN (*Jour. Biol. Chem.*, 25 (1916), No. 2, pp. 337-350).—"The ninhydrin reaction is given by organic bases of the type RCH_2NH_2 and R_2CHNH_2 where one radical is negative in character. Other bases which readily yield ammonia or are readily oxidized give the ninhydrin reaction. With the fatty amines and in the presence of pyridin the strongest reaction is given by the simplest members. Amides give no reaction with ninhydrin. Guanidin and its derivatives give a negative test."

The nonspecificity of the ninhydrin reaction for amino acids, especially in very small amounts and in the presence of large amounts of ammonium salts, is emphasized.

On the determination of phytosterol in animal fats according to Bömer's acetate procedure with the separation of the stearins by precipitation with digitonin, B. KÜHN, F. BENGEL, and J. WEWERINKE (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 29 (1915), No. 8, pp. 321-329).—The authors outline a modified procedure as follows:

Fifty gm. of fat is heated with 100 cc. of alcoholic potassium hydroxide (200 gm. KOH dissolved in 70 per cent alcohol and made up to 1 liter) for 15 minutes on a water bath. The clear soap solution is diluted with 150 cc. hot water and then 50 cc. hydrochloric acid (specific gravity 1.124) is added. The clear fatty acids are then separated from the KCl-glycerin mixture by filtration. To the warm liquid acids 25 cc. of a 1 per cent solution of digitonin in 96 per cent alcohol is added, and the mixture is thoroughly stirred and allowed to set on the water bath at a temperature of 70° C. for from 0.5 to 1 hour, according to the amount of stearins present. To the mixture, from 15 to 30 cc. of chloroform is now added and the precipitate carefully filtered on a Witte plate with gentle suction. The precipitate is washed from three to five times with chloroform and in the same manner with ether. When free from fatty acids it is dried for ten minutes at from 90 to 100°. The precipitate is now strongly boiled with from 3 to 5 cc. of acetic anhydride for about five minutes, in which time the reaction is usually complete. Four volumes of 50 per cent alcohol are now added and the mixture cooled. After from five to ten minutes the precipitated acetate is filtered through a small filter, washed with 50 per cent alcohol, and then recrystallized from ether solution.

Analytical data of the melting points of stearin acetates obtained from 75 different samples of fats and mixtures are submitted.

The determination of stearins by means of digitonin, O. PFEFFER (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 31 (1916), No. 2, pp. 38-40).—The procedure modified by Kühn et al. (see previous abstract) was found to yield excellent results.

The physiology of souring of pure and watered milk, F. REISS (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 31 (1916), No. 2, pp. 41-45).—From experimental data submitted it is concluded that within rather wide limits of milk watering in the course of lactic acid fermentation amounts of lactose are fermented which are inversely proportional to the degree of watering. While more conclusive evidence is necessary to answer the question whether the degree of acidity can be definitely used as an index of the amount of water, it is deemed certain that from the degree of acidity of sour milk it can safely be determined whether or not the milk was originally watered.

The gravimetric determination of reducing sugars in cane products, G. P. MEADE and J. B. HARRIS (*Jour. Indus. and Engin. Chem.*, 8 (1916), No. 6, pp. 504-509).—In clarifying the sugar solutions the authors found that different results were obtained by the use of varying amounts of neutral lead acetate solution.

"Carbonate, sulphates, and oxalates are not interchangeable as delending agents, oxalates giving results from 4 to 5 per cent higher on the weight of copper than where either of the others is used. Kieselguhr only, without the use of lead or other reagent, gives a clear filtrate, both with final molasses and raw sugar, and the solution offers no mechanical difficulty in the precipitation and collection of the copper precipitate. Without lead the results are slightly lower than where lead and oxalate are used."

Results obtained by weighing the cuprous oxid were about 5 per cent higher on the weight of copper than those obtained by igniting and weighing as cupric oxid. Volumetric iodid determinations of the copper checked the cupric oxid results.

It is indicated that, "under strict specifications as to the quantity and class of reagents, any method for the preparation of the solution for analysis will give results which check within themselves."

The determination of the gelatinizing temperature of the starches from the grain sorghums by means of a thermo-slide, C. K. FRANCIS and O. C. SMITH (*Jour. Indus. and Engin. Chem.*, 8 (1916), No. 6, pp. 509-511, figs. 2).—This material has been previously noted from another source (*E. S. R.*, 35, p. 108).

A colorimetric method for the estimation of free formaldehyde and hexamethylenamin, R. J. COLLINS and P. J. HANZLIK (*Jour. Biol. Chem.*, 25 (1916), No. 2, pp. 231-237).—A colorimetric method in which the phloroglucinol reagent (0.1 gm. phloroglucinol in 10 cc. 10 per cent sodium hydroxid) is used is described.

Permanent color standards are prepared from mixtures of Congo red and methyl orange. Standard mixtures for concentrations of formaldehyde between 1:1,000,000 and 1:20,000 have been determined and are submitted. It is indicated that the procedure described is more accurate than the Romijn, the United States Pharmacopoeia method, and the hydroxid pressure method. It is directly applicable for the determination of free formaldehyde in urine.

[Report of the fermentation and bacteriological section], H. MÜLLER-THURGAU and A. OSTERWALDER (*Landw. Jahrb. Schweiz*, 29 (1915), No. 5, pp. 537-568).—Experiments on the value of washing the fruit preliminary to pressing demonstrated that the washing did not yield a purer fermentation or a more stable product. In the reduction of the acidity of wines, partial neutralization with calcium carbonate and further reduction to any degree of acidity desired by the action of *Barillus gracilis* at various temperatures was found to yield satisfactory results.

From results obtained in connection with studies on the influence of sulphurous acid on fermentation processes in wines and fruit juices, it is indi-

cated that the amount of sulphur dioxide which actually inhibits alcoholic and the various acid fermentations so varies that no exact amount to be used can be prescribed. An investigation on the effect of sulphur dioxide on wine diseases indicated that the use of sulphur dioxide is a valuable aid in preventing the lactic-acid disease which is so prevalent in certain fruit juices, especially those obtained from overripe pears and apples. On account of the presence of aldehydes in the juices the sulphurous acid soon becomes inactive, so that for reliable results sufficient quantities of potassium metabisulphite should also be added, but because of the continued production of aldehyde during fermentation the quantity of sulphur dioxide and potassium metabisulphite necessary should be largely regulated by the activity of the fermentation. An undue excess is to be avoided at the beginning of the fermentation, as it may injure the bacteria (*B. manniotopocum* and *B. gracilis*), although not the yeasts.

[Report of the chemical section], W. J. BARAGIOIA, C. GODET, and O. SCHUEPPI (*Landw. Jahrb. Schweiz*, 29 (1915), No. 5, pp. 568-572).—These pages briefly report the results obtained in the investigations on the difference between acid content and degree of acidity; analytical investigations on the ripening of grapes and the wine obtained therefrom; acid reduction in wine in relation to its analysis, physicochemical properties, and hygienic value; the fermentation of grape must under paraffin oil; and the various combinations of sulphur in wine and their determination.

METEOROLOGY.

Weather as a business risk in farming. W. G. REED and H. R. TOLLEY (*Geogr. Rev.*, 2 (1916), No. 1, pp. 48-53, figs. 4; *abs. in U. S. Mo. Weather Rev.*, 44 (1916), No. 6, pp. 354, 355, figs. 3).—It is pointed out in this article that the occasional occurrence of unfavorable weather conditions is a risk which must be recognized by successful farmers, and it is stated that in the case of phenomena whose distribution follows the "normal law of frequency" this risk may be determined with a fair degree of accuracy. A method of determining the risk of frost occurrence is described in this paper, and the opinion is expressed that a method of computing the risk from other more complicated phenomena can be worked out.

"To compute the time available for plant growth in a given proportion of the years the most satisfactory method is that based on the risk at each end of the growing season. If the chance of safety on a given date in spring is one-half and that on a given date in fall is one-half, the chance of safety for the whole period between is one-half multiplied by one-half; that is, one-fourth. For many important crops about a four-fifths chance of safety is essential for continued success. . . . For any place the length of the available growing season (that is, number of days for which the chance is four in five), beginning at the date when the frost risk falls to 10 per cent, is the number of days between this date and the date on which the chance of fall frost rises to 10 per cent."

A table is given which simplifies the computation. It is stated that "although this method of determining business risk is subject to limitations because of the shortness of the individual records, a careful examination of the records shows that in the large the computed dates on which the frost risk rises (or falls) to 10 per cent, when compared with the actual number of occurrences, is a very close agreement. From a total of 27,157 observations the lack of agreement between the computed and counted cases was but 17 in 10,000."

Critical period of growth (*U. S. Dept. Agr., Nat. Weather and Crop Bul.*, 22 (1916), pp. 2, 3, fig. 1).—Attention is called especially to the use of rainfall charts in relation to the critical periods of corn, the most important of which is the ten days following the date of blossoming.

Weather and the yield of corn (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 14 (1916), p. 2, fig. 1*).—The relation between the yield of corn and the rainfall in Ohio, Indiana, Illinois, Iowa, Nebraska, Kansas, Missouri, and Kentucky for the 28 years from 1888 to 1915, inclusive, is shown in a diagram and briefly discussed. The most striking fact brought out is that whenever the rain for July has been above the normal the yield was above the normal in every instance. Whenever the rainfall was below the normal the yield has also been below in every year except five.

The four greatest corn States (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 15 (1916), p. 2, fig. 1*).—It is shown that the average yield of corn for Indiana, Illinois, Iowa, and Missouri is 32 bu. per acre, and that the average July rainfall for the region covered by these States is 3.9 in. The preeminence of these States in corn production is shown to be closely correlated with the July rainfall.

Rainfall and temperature and corn yield (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 18 (1916), pp. 2, 3, fig. 1*).—The effect of July rainfall and temperature on the yield of corn in Ohio during the period from 1854 to 1915, inclusive, is shown in a diagram and briefly discussed. The July rainfall is shown to be the dominating factor.

Weather and yield of potatoes (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 19 (1916), pp. 2, 3, fig. 1*).—A study of the effect of temperature and rainfall upon the yield of potatoes in Ohio, Michigan, and New Jersey is reported, showing that the temperature of July is the most important weather factor in those States. A cool July is most favorable.

Monthly Weather Review (*U. S. Mo. Weather Rev., 44 (1916), Nos. 5, pp. 243-319, pls. 9, figs. 18; 6, pp. 521-579, pls. 14, figs. 28*).—In addition to weather forecasts, river and flood observations, and seismological reports for May and June, 1916; lists of additions to the Weather Bureau Library and of recent papers on meteorology and seismology; notes on the weather of the months; solar and sky radiation measurements at Washington, D. C., during May and June, 1916; condensed climatological summaries; and the usual climatological tables and charts, these numbers contain the following articles:

No. 5.—Circumhorizontal Arc Observed, by J. T. Gray; The Blue of the Sky and Avogadro's Constant, by D. Pacini; Photography of the Zodiacal Light and Counter glow, by A. E. Douglass; Propagation of Sound in the Atmosphere, by E. van Everdingen; Spontaneous Ionization of the Aqueous Vapor of the Atmosphere, II, by G. Oddo; Variation of the Emanation Content of Springs, by R. H. Ramsey; Planetary Phenomena and Solar Activity, by T. Köhl; Free-air Data by Means of Sounding Balloons, Fort Omaha, Nebr., July, 1914 (illus.), by W. R. Blair; Meteorological Symbols (illus.), by C. F. Talman; The Coefficient of Correlation as a Measure of Relationship, by C. N. Moore; Rainfall in China, 1900-1911 (illus.), by Co-Ching Chu; American Definition of "Sleet," by C. Abbe, Jr.; Two Abnormal Pressure Distributions in Italy (illus.), by F. Eredia; Fog as a Source of Water Supply, by W. G. Reed (see p. 619); A Simple Wind-Velocity Indicator for Use with the Robinson Anemometer (illus.), by B. C. Kadel; Diurnal Variation of Underground Temperature, by S. Sato; Aleksandr Ivanovich Voelkov, 1842-1916; The Chinese Weather Bureau, by Co-Ching Chu; Flood in the Lower Mississippi, Spring, 1916, by W. E. Barron; and Rainfall and Floods in China, by S. T. Suen.

No. 6.—Meteor of June 28, 1916, Over Northeastern Texas (illus.), by H. H. Martin; Observations of Meteor Trains; Meteor of May 7, 1916, in Eastern Mississippi, by J. H. Jaqua; Meteor of May 7, 1916, at Demopolis, Ala., by J. G. Whitfield; Work of the American Meteor Society, 1914 and 1915, by C. P. Olivier; Canadian Aerological Research; Use of a Flagpole in Calibrating Kite

Anemometers (illus.), by B. J. Sherry; Solar Variability, by C. G. Abbot et. al.; Tropical Rains: Their Duration, Frequency, and Intensity (illus.), by O. L. Fassig (see below); Mechanism of Cyclones, by F. J. W. Whipple; Causes Contributory to the Annual Variation of Latitude, by H. Jeffreys; Meteorological Aspects of Oceanography (illus.), by H. Pettersson; Precipitation Over the Southeast Rocky Mountain Slope (illus.), by C. Hallenbeck; Fog in Relation to Wind Direction on Mount Tamalpais, Cal., by H. H. Wright; On the So-called Change in European Climate During Historic Times, by H. H. Hildebrandsson (see below); Violent Easterly Winds at Tatoosh Islands, Wash. (illus.), by R. C. Mize; Weather as a Business Risk in Farming (illus.), by W. G. Reed and H. R. Tolley (see p. 616); and Snow Surveys in Big Cottonwood Canyon, Utah, 1912-1916 (illus.), by H. K. Burton.

On the so-called change in European climate during historic times, H. H. HILDEBRANDSSON (*Nova Acta Reg. Soc. Sci. Upsal.*, 4, ser., 4 (1915), No. 5, pp. 31, pls. 3; *U. S. Mo. Weather Rev.* 44 (1916), No. 6, pp. 344-352).—From an exhaustive review of data from various sources on the subject, the general conclusion is reached "that there exist everywhere climatic variations of long and short duration, but it is not possible to prove that the climate of Europe has changed for either better or worse during historic times."

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 3 (1916), Nos. 5, pp. 224, pls. 2, figs. 4; 6, pp. 224, pls. 2, figs. 4).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for May and June, 1916, respectively.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSKANDER and J. S. SIMS (*Massachusetts Sta. Met. Bula.* 331-332 (1916), pp. 4 each).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during July and August, 1916, are presented. The data are briefly discussed in general notes on the weather of each month.

Tropical rains: Their duration, frequency, and intensity, O. L. FASSIG (*U. S. Mo. Weather Rev.*, 44 (1916), No. 6, pp. 329-337, figs. 15).—The rainfall phenomena of Porto Rico and of Maryland are compared. It is shown that there is a fairly even distribution of rainy days throughout the year in both regions. Rains, especially excessive rains, are more frequent and more uniformly distributed throughout the year in the tropical region.

"Frequent moderate rains are generally more favorable for plant growth than heavier rains, assuming equal total amounts for the year. There is a wide range in the frequency of rains of 0.01 to 0.1 in. in Porto Rico, a condition which is probably common to all regions with pronounced differences in topography. As the amounts grow larger the range rapidly decreases. The best and most extensive tobacco plantations of Porto Rico are situated in the portion of the island having the greatest number of light rains, with a total annual amount close to the average for the entire island. The station at Caguas, typical of this region, shows a record of 160 days with rainfall from 0.01 to 0.1 in., with a total annual frequency of 262 days and a total rainfall of 68 in. In the mountains of the western portion of the island, a region noted for the abundance and fine quality of its coffee, the rainfall is very heavy. A peculiarity of the rains of this region is that they show a maximum frequency of amounts between 0.2 and 0.3 in., whereas the usual record shows a very decided preponderance of amounts less than 0.1 in."

Fog as a source of water supply, W. G. REED (*U. S. Mo. Weather Rev.*, 44 (1916), No. 5, p. 288).—Referring to an article by Descombes, previously noted (*E. S. R.*, 34, p. 614), it is stated that "there is apparently a close relation

between the occurrence of summer fog and the distribution of the redwood (*Sequoia sempervirens*) in California. In addition, a result of the fog is easily seen wherever there are single trees, such as is the case on the Berkeley Hills of the coast ranges, which are in process of reforestation. During the summer fogs the small trees are dripping with moisture, although the ground away from the trees is perfectly dry. As a result the grass beneath each tree remains green throughout the year."

The climate of Roumania in relation to dry farming, L. GEORGESCO (*Vie Agr. et Rurale*, 6 (1916), No. 11, pp. 191-194, figs. 2; *abs. in Rev. Sci. [Paris]*, 54 (1916), 11, No. 13, pp. 405, 406).—It is explained that the climate of Roumania is typically continental and on the plains is such as to make the use of dry-farming methods desirable. The annual rainfall is seldom less than 500 or more than 800 mm., the mean being about 600 mm. (about 23.6 in.) It is smaller on the plains (300 to 500 mm.), and increases with the elevation (1300 to 1,600 mm. in the mountains). It also varies in distribution seasonally.

Even in seasons of low rainfall the amount is sufficient for good wheat crops, provided it is suitably distributed. The average annual temperature is about 10° C. (50° F.) on the plains and from 8 to 9° at the higher elevations. There are, however, wide seasonal extremes in temperature (—35 to 40°). The daily extremes are also wide. Cold, high winds are common in winter, and dry, hot winds in summer. Bright sunshine varies from 50 to 80 per cent of the total possible. The humidity of the air varies from 50 to 60 per cent in summer and from 85 to 90 per cent in other parts of the year. The climatic conditions are such as to make early seeding in the fall and late seeding in the spring necessary.

The influence of weather conditions upon the amounts of nitrogen acids in the rainfall and atmosphere in Australia, O. MASSON, V. G. ANDERSON, D. AVERY, and H. A. HUNT (*Rpt. Brit. Assoc. Adv. Sci.*, 1915, pp. 87-94, figs. 3).—This is a preliminary report upon the organization of investigations covering the whole of Australia (16 stations), similar to those reported by Anderson for the region of Melbourne (*E. S. R.*, 33, p. 617). The plan and purpose of this work and the apparatus and methods to be used are briefly described.

Discussion on smoke abatement and air pollution (*Rpt. Brit. Assoc. Adv. Sci.*, 1915, pp. 387-393).—Brief notes are given on discussions at the Manchester meeting of the British Association for the Advancement of Science, 1915, on the work of the Manchester Air Pollution Advisory Board, the work of the Sheffield Health Committee, damage to vegetation caused by atmospheric pollution by smoke, improvements in domestic fire grates, recent improvements in gas fires, and other aspects of the smoke question.

SOILS—FERTILIZERS.

Soil temperature, G. J. BOUYOUKOS (*Michigan Sta. Tech. Bul.* 26 (1916), pp. 133).—A continuation for three years of the field experiments previously noted (*E. S. R.*, 29, p. 618) is reported, together with the final conclusions drawn from the entire investigation.

"The field studies on the temperature of different types of soil, namely, gravel, sand, humus loam, clay, and peat at 6-, 12-, and 18-in. depths, showed that when the surface of all these soils was covered with a thin layer of sand they had almost exactly the same average temperature throughout the year except during a short period in the spring when thawing was taking place. . . . During the summer months the peat [had] a monthly average temperature of a few tenths of a degree higher than the mineral soils. In the fall, the sand and gravel possessed a slightly higher monthly average temperature than

the peat. Whenever rapid and sudden changes of air temperature occurred the sand and gravel warmed and cooled the fastest, followed by clay, loam, and peat, respectively. The equilibrium [was] quickly reestablished. The degree of amplitude was greatest in sand and gravel, somewhat smaller in loam and clay, and least in peat. The highest fluctuation occurred in summer and the lowest in winter. The maximum temperature was approximately the same for all types of soil, after complete thawing had taken place, but the minimum varied somewhat; it was lowest in sand and gravel, slightly higher in clay and loam, and highest in peat. . . .

"When the same types of soil were not covered with a thin layer of sand but their natural surface was allowed to be exposed to the atmosphere . . . their average temperature . . . was about the same during the fall and winter months, but varied somewhat during the spring and summer months. During the latter seasons the sand and gravel [had] the highest average temperature, the clay and loam slightly lower, and peat the lowest. . . . In the spring the peat [did] not thaw and its temperature [did] not approach that of the mineral soils after complete thawing as rapidly as when its surface was covered with the thin layer of sand. Besides the average temperature the order of the maximum and minimum temperature [was reversed] in the various types of soil under the two surface conditions. . . .

"The average air temperature was lower than that of any soil at the 2-, 4-, 6-, 12-, and 18-in. depths, throughout the year. . . . The maximum temperature of all the soils at $\frac{1}{4}$ -in. depth was about 30° F. higher during hot and clear days than that of the air at an elevation of 4 ft. The minimum temperature of all the soils except peat, however, immediately at the surface was only about 1 or 2° higher, as a monthly average, than that of the air at a height of 4 ft. . . . Unless the various soils were frozen they always had a gradient of temperature at their adjacent depths [which], however, reversed itself between day and night during the warm part of the year to the depth that the diurnal-nocturnal amplitude of oscillation of temperature extended. . . .

"The rate at which the maximum and minimum temperature waves traveled through any particular soil tended to follow approximately a mathematical law. . . . Thus, the lag of the maximum and minimum epochs tended to be approximately proportional to the depth in all the different types of soil.

"The decrease of the diurnal-nocturnal amplitude of temperature with the increase in depth also followed a mathematical law in all the diverse types of soil and the geometric progression law. . . . The diurnal-nocturnal amplitude of oscillation of temperature decreased in geometric progression as the depth increased in arithmetic progression, in all the different types of soil.

"The four years' data obtained on the temperature of sand to which was added different percentages of organic matter (peat) showed that during the fall and winter months all these soils had approximately the same degree of average temperature, but in the spring and summer months it varied somewhat. During the latter months the sand which received no organic matter and had a white colored surface and the peat had about the same and lower average temperature than the other soils which were treated with various percentages of peat. . . . The amplitude of temperature at the 3- and 5-in. depths was high, but approximately of equal degree in all the treated and untreated soils, but comparatively low in the peat. . . .

"The uncultivated soil had practically the same or only a few tenths of a degree higher temperature during the spring months than the cultivated and only about 1° higher during the summer months. During the fall and winter months there was hardly any difference. There did exist, however, a very marked difference in average temperature between the two bare soils and one

covered with growing vegetation. . . . Immediately upon the commencement of growth of the vegetation the temperature of the soil or grass land became decidedly lower than that of the cultivated and uncultivated soil. The maximum difference [was] reached in June and July, when the sod soil at the 7-in. depth, for instance, [was] about 6° colder than the bare soils. This difference, however, [became] smaller and smaller, so that by September it entirely disappeared, and by October the order [was] reversed; the bare plots [became] colder and the sod warmer. The latter continued to have a higher temperature throughout the fall and winter months. . . .

"In exceptionally cold weather the soil covered with vegetation and a layer of snow had 25° higher temperature than a bare soil at 3-in. depth. Certain topographic positions have a marked controlling influence upon the soil temperature. A southern exposure had about 2° higher average temperature than a northern during the spring and summer months, but during the fall and winter months both locations were equally warm. The soil temperature at a river bank was far below that of the south and north slope during the spring and summer months, but slightly higher during the fall and winter months. The marked influence of the slant of the surface with respect to the position of the sun on the soil temperature is manifested on a cultivated soil with very lumpy and uneven surface. The sides of the lumps or dead furrows facing the sun in the morning had a higher temperature than those shaded."

Fundamental interrelationships between certain soluble salts and soil colloids, L. T. SHARP (*Univ. Cal. Pubs. Agr. Sci.*, 1 (1916), No. 10, pp. 291-333, figs. 3).—It was found in cylinder experiments that clay loam soil, exposed to natural conditions and to which surface applications of solutions of sodium chlorid, sulphate, and carbonate had been made, became very impervious to water, difficult to cultivate, and manifested the characteristics of a high degree of diffusion. Laboratory studies showed that the salts had moved downward into the lower layers of soil and that only the surface soil was affected.

"The deflocculated condition resulting from adding certain salts to and subsequently washing them from soils can be reproduced in the laboratory. The deflocculation of soils [so] treated . . . is intimately associated with the leaching of the NaCl and Na₂SO₄ down into the lower layers of soil by water. In the case of Na₂CO₃ the leaching process is not so essential for the diffusion of the soil colloids. The addition of NaCl, Na₂SO₄, and Na₂CO₃ to the soil when followed with applications of water was particularly effective in diminishing the rate of percolation through the soil so treated. NaCl and Na₂SO₄ in constant contact with the soil increased the rate of percolation, except when a comparatively dilute solution of NaCl was slowly passed through the soil for a considerable period of time.

"The soil treated with NaCl, NaOH, Na₂CO₃, and other salts, followed by leaching with water, yields a suspension in water containing approximately ten times as much solid matter as the same soil washed with water only. A real diffusion in such salt-treated soils seems evident. The soil once diffused by washing out added NaCl requires considerably more salt to completely flocculate it, than does the water-washed soil. Likewise the injured physical condition of such soils is not readily repaired by a second addition of NaCl.

"The portion of the organic matter of the soil known as humus has little or no connection with the appearance of diffusion in salt-treated, water-washed soils. The diffusion in soils treated as described above seems to be closely associated with the direct addition of sodium to or with the absorption of sodium by the soil, thereby producing a new silicate complex of a colloidal character in the soil . . . [which] is formed simultaneously with the interchange of ions occurring between the salt and the soil. The washing process serves, in the case

of neutral salts, to remove flocculating agents. The loss of calcium and magnesium from the soil bears little or no relation to the flocculation appearing in salt-treated, water-washed soils except in so far as it may be a measure of the absorbed sodium. The presence of the OH-ion does not seem to be an essential factor in the diffusion of salt-treated, water-washed soils. Na_2CO_3 and NaOH produce markedly different effects on suspensions of the soil. The acid ion of the salt is not an important factor in the deflocculation phenomena following the washing out of salts from soils. Sodium, potassium, and ammonium seem to produce the colloidal silicate complex when salts of these metals are applied to soils, while calcium does not. Dilute solutions of acids and salts possess flocculating powers on suspensions of the soil. It is not essential in every case to wash all of the salt out in order to bring about diffusion."

How much plant food is removed from soils by crops and drainage water? H. VON FELLITZEN (*Svenska Mosskulturför. Tidskr.*, 29 (1915), No. 3, pp. 193-210, fig. 1).—Lyximeter experiments on swamp soil and so-called white-moss soil are reported, which showed that the losses of nutritive constituents in drainage water were much smaller in pastures than in cereal fields and were greater in swamp than in white-moss soil.

The chemical composition of the hay from the two soils also differed. The swamp hay contained more potassium, phosphorus, and nitrogen than the white-moss soil hay, both on fertilized and unfertilized plats. The lime content was greater in the hay from the limed white-moss soil.

White-moss soil, when completely fertilized, became enriched in potash and phosphoric acid but lost nitrogen in the drainage water. Swamp soil, when completely fertilized, retained phosphoric acid but lost potash and nitrogen. The percentage composition of the soil was, however, but little affected.

Calcium, magnesium, potassium, and sodium in the drainage water from limed and unlimed soil. T. L. LYON and J. A. BIZZELL (*Jour. Amer. Soc. Agron.*, 8 (1916), No. 2, pp. 81-87).—Experiments conducted at Cornell University with limed and unlimed clay-loam soil, growing corn, oats, wheat, timothy, and clover, are reported, in which the drainage water resulting from natural rainfall was analyzed twice yearly for five years.

It was found that "of the bases, calcium, magnesium, sodium, and potassium, the last named is most firmly held in the soil used. . . . An application of burned lime corresponding to the lime requirement of the surface foot of soil was not accompanied by any appreciable increase in the quantity of potassium present in the drainage water, [and] did not result in any greater quantity of potassium in the crops raised on the limed soil than in those that grew on the soil that received no lime. So far as could be ascertained . . . there was no liberation of potassium effected by the lime treatment. Magnesium was the only one of the four bases that appeared in larger quantity in the drainage from the limed than from the unlimed soil. The calcium-magnesium ratio is much broader in the drainage water from this soil than in the soil itself. The effect of an annual application of potassium sulphate at the rate of 200 lbs. per acre was to increase materially the quantity of calcium and magnesium in the drainage water, but not to increase the quantity of potassium. The sum total quantity of the bases calcium, magnesium, potassium, and sodium was less in the drainage water of the soil that received an application of lime than in the water from the unlimed soil."

The loss of sulphur in drainage water. T. L. LYON and J. A. BIZZELL (*Jour. Amer. Soc. Agron.*, 8 (1916), No. 2, pp. 88-91).—Experiments conducted at Cornell University on a clay loam soil growing five crops, in which the drainage water for four years was analyzed for sulphates, are reported.

It was found that "the sulphur removed in the drainage water from an unplanted, unlimed soil that had received some farm manure but no commercial fertilizer amounted to 44 lbs. per acre annually. The application of lime increased the quantity of sulphur removed by the drainage water. Soil on which crops were grown lost less sulphur in the drainage water than did unplanted soil when otherwise similarly treated. The annual application of sulphate of potash at the rate of 200 lbs. per acre markedly increased the quantity of sulphur in the drainage water. From one-half to two-thirds of the sulphur applied annually as sulphate of potash was removed in the drainage water."

Physicochemical studies of soils.—IV, **The cause of the fixation of phosphoric acid by the soil**, U. PRATOLONGO (*Staz. Sper. Agr. Ital.*, 48 (1915), Nos. 5-7, pp. 457-499, figs. 2; *abs. in Chem. Zentbl.*, 1915, 11, No. 17, p. 917).—Continuing previous work (E. S. R., 35, p. 21), experiments with loose alluvial soils, alluvial clay, humus soil, and calcareous clay soils and monobasic phosphates are reported. The results are taken to indicate that the fixation of phosphoric acid can be attributed to absorption processes by positively charged soil colloids, mainly the hydroxids of iron, aluminum, and manganese, and also to chemical fixation by calcium salts.

The oxidizing power of soils, F. C. GERRETSEN (*Arch. Suikerindus. Nederland. Indië*, 23 (1915), No. 21, pp. 833-847, figs. 2; *Meded. Proefstat. Java-Suikerindus.*, 5 (1915), No. 11, pp. 317-331, figs. 2; *abs. in Chem. Abs.*, 10 (1916), No. 4, p. 593; *Internat. Inst. Agr. [Rome]*, Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, pp. 1583, 1584; *Jour. Soc. Chem. Indus.*, 35 (1916), No. 6, p. 372).—In tests with 19 cane soils having normal oxidizing power, it was found that when tested before and after sterilization the amount of iodine liberated by the soils from 1 per cent potassium iodide solution decreased noticeably. This is taken to indicate that "in case soils have an oxidizing power it is at least partly due to oxidases." In six cases where the stand of cane was good from 120 to 354 mg. of iodine were liberated by 100 gm. of soil; in three cases where the stand was fair to moderately poor from 79 to 184 mg. were liberated; and in eleven cases where the stand was bad there was no iodine liberated in eight cases and up to 47 mg. in the others. "The amount of gaseous oxygen necessary to liberate the average amount of iodine would amount to 80 to 100 per cent of the pore space in a heavy clay soil. Hence it is concluded that the poor stand of cane on strongly reducing soils is due to lack of oxygen at the root tip."

A method of determining the oxidizing power of soil by means of potassium iodide solution is described.

The principles of crop production, E. J. RUSSELL (*Jour. Chem. Soc. [London]*, 107 (1915), No. 638, pp. 1838-1858, pl. 1, figs. 9; *abs. in Nature [London]*, 96 (1916), No. 2412, pp. 579-583, figs. 4).—This is a brief review of work by the author and others in which the main factors influencing crop production are discussed, special attention being drawn to the so-called limiting factor.

Soil survey of Walker County, Alabama, J. O. YEATCH, A. M. O'NEAL, JR., and J. F. STROUP (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils*, 1915, pp. 39, fig. 1, map 1).—This survey, made in cooperation with the State of Alabama and issued July 31, 1916, deals with the soils of an area of 510,720 acres in northwestern Alabama, the surface of which is prevailingly undulating to hilly, with small areas of extremely rough and broken country.

"The soils of the greater part of the county are residual in origin, and are derived from shales and fine-grained sandstones. The silt loam and fine sandy loam types of soil predominate. The soils are generally well drained and easily tilled." Exclusive of steep broken land, 12 soil types of 8 series are mapped, of which the Dekalb very fine sandy loam, shale loam, and silt loam, and the

Hanceville silt loam cover 27.3, 21.5, 11, and 14.3 per cent of the area, respectively.

Soil survey of Pennington County, Minnesota. W. G. SMITH, N. M. KERN, and F. WARD (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 28, pl. 1, fig. 1*).—This survey issued July 15, 1916, deals with the soils of an area of 388,480 acres in northwestern Minnesota, the surface of which is mainly level to undulating, with a general slope toward the southwest. "The natural drainage of the county is for the most part poor and must be assisted by artificial means."

The soils of the county are of glacial origin. Including peat, 9 soil types of 3 series are mapped, of which the Fargo clay loam, Fargo loam, peat, and Benoit loam cover 36.4, 17.3, 17.1, and 14.5 per cent of the area, respectively.

The chemical composition of some Minnesota peat soils, DE F. HUXGENFORD (*Jour. Amer. Peat Soc., 9 (1916), No. 2, pp. 74-81*).—Analyses made at the Minnesota Experiment Station of 28 samples of peat, 10 of which were from the muskeg type and 18 from the grass peat, are reported and discussed.

The muskeg peat, in general, contained a higher percentage of volatile matter than the grass peat, this averaging 86.84 per cent in the former and 73.71 per cent in the latter. The nitrogen content was higher in the grass than in the muskeg peats, the former containing an average of 1.874 per cent and the latter of 2.569 per cent. The percentages of both phosphoric acid and potash were also somewhat higher in the grass than in the muskeg peats.

The greatest difference in composition between the muskeg and the grass peat was found in their lime content, although there was considerable variation in the amount present in different samples of both types. The muskeg contained on the average 1.237 per cent of lime, but different samples varied from 0.25 per cent to 5.97 per cent. The grass peat contained 3.35 per cent as an average, and varied from 1.03 to 14.36 per cent.

The analysis is taken to indicate that Minnesota peat soils resemble but do not agree exactly in composition with those of European countries.

The soils of Mississippi. W. N. LOGAN (*Mississippi Sta. Tech. Bul. 7 (1916), pp. 84, pl. 1, figs. 15*).—This is a revision and an enlargement of Technical Bulletin 4 of the station (*B. S. R., 29, p. 416*), to which a brief discussion of the general properties of soil and chapters on soil acidity and its correction and on geological formations from which the soils were derived have been added.

Soil survey of Dunklin County, Missouri. A. T. SWEET, B. W. TILGEMAN, H. H. KRUSEKOPF, C. E. DEARDORFF, W. I. WATKINS, and E. W. KNOBLE (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 47, pls. 3, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station and issued August 8, 1916, deals with the soils of an area of 343,040 acres in southeastern Missouri which consists topographically of hill lands, bench lands, including sandy ridges and glade lands, and low bottom lands subject to overflow.

"Nearly all parts of Dunklin County have been drained directly or at least greatly benefited through the drainage of low-lying adjacent areas. . . . The most important soils . . . are the sandy terrace or 'sand-ridge' soils."

Twenty-four soil types of nine series are mapped, of which the Sharkey clay and the Lintonia fine sandy loam and fine sand cover 21.1, 15.2, and 14.8 per cent of the area, respectively.

Soil survey of Roger Mills County, Oklahoma. J. A. KERR, J. H. AGEE, and E. C. HALL (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 32, fig. 1, map 1*).—This survey, issued July 11, 1916, deals with the soils of an area of 726,400 acres in the Great Plains region in western Oklahoma.

The surface consists of a high rolling plain, deeply dissected by flowing streams. The topography of the plain is undulating to gently rolling, while that of the lowland is hilly. Including rough broken land and dune sand, 22 soil types of eight series are mapped, of which the Vernon clay loam and very fine sandy loam cover 19 and 9.2 per cent of the area, respectively, rough broken land 11.8, and the Richfield fine sandy loam 10.1 per cent.

Soil survey of Lancaster County, Pennsylvania, B. D. GILBERT, W. B. CORN, E. L. MORFITT, and J. F. COX (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 70, fig. 1, map 1*).—This survey, made in cooperation with the Pennsylvania College and Station and issued July 21, 1916, deals with the soils of an area of 602,240 acres in southeastern Pennsylvania which "consists of a central valley or lowland occupying about 50 per cent of its total area, surrounded on all sides by highland, except where narrow belts of the lowland project from the main area and extend to or beyond the county line." The regional drainage is mature and complete.

The soils of the county are residual and alluvial in origin and the loams and silt loams predominate, including rough stony land and meadow. Thirty-six soil types of 17 series are mapped, of which the Hagerstown silt loam and the Manor loam cover 24 and 20.6 per cent of the area, respectively.

Soil survey of Brazos County, Texas, J. O. VEATCH and C. S. WALSHOE (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 53 fig. 1, map 1*).—This survey, made in cooperation with the Texas Experiment Station and issued July 10, 1916, deals with the soils of an area of 369,920 acres in east-central Texas lying in the Gulf Coastal Plain. The topography is level to gently rolling and the greater part of the county is well drained.

The county "embraces a rather wide range of soils, having peculiar differences in texture, structure, drainage, or other characteristics, which . . . affect in some degree crop yields and the ease or difficulty of cultivation. . . . Two general groups are recognized, (1) the upland soils and (2) the bottom land and terrace soils. The upland soils are mainly derived from underlying sedimentary deposits. The bottom and terrace soils are alluvial." Thirty soil types of 13 series are mapped, of which the Lufkin and Susquehanna fine sandy loams cover 40.3 and 11.3 per cent of the area, respectively.

Soil bacteriology, C. M. HUTCHINSON (*Rpt. Agr. Research Inst. and Col. Phys., 1914-15, pp. 79-89; Ann. Rpt. Bd. Sci. Advicc India, 1914-15, pp. 110-116*).—Continuing work previously reported (*E. S. R., 53, p. 513*), it was found in studies of bacteriotoxins in soils that "the inhibition of nitrification occurring in soils under water-logged or semianaerobic conditions was not due merely to lack of oxygen required for formation of the completely oxidized product, but to the action of toxins resulting from the activity of certain classes of bacteria which rapidly multiply under these conditions. . . . It was found that such toxins result from decomposition of organic nitrogen compounds by bacterial action under semianaerobic conditions, and further proof that the inhibition of nitrification is not due merely to shortage of oxygen was afforded by the observation that, with the same air supply as was sufficient for complete nitrification of ammonium sulphate in soil, nitrification of oil cake containing the same amount of nitrogen was completely inhibited. . . .

"It was found in actual practice in the field that germination in a soil which had been water-logged was interfered with and that the ensuing crop was consequently poor, nor was this remedied by application of nitrate of soda, although the use of superphosphate was successful. Laboratory experiments showed that rapid reduction of nitrate takes place in water-logged soil, a large proportion of nitrite being formed. . . . It was found in the laboratory that superphosphate

had a neutralizing action upon the toxicity to bacteria of extracts of certain soils, and this was traced to the free acid. . . .

"Ammonification proceeded at the normal rate in soil under semianaerobic conditions and was apparently not interfered with by the bacteriotoxins produced, although the activity of such ammonifiers as *Bacillus mycoides* is actually lowered by the presence of B. X. This latter organism does not appear to be universally present in soils. No concentration of ammonia above that in the aerated control was found, nor was this gas given off by the anaerobic soil."

In a special experiment to test the action of the carbon dioxide formed in soil by bacterial action upon nitrification in that soil, it was found that "under partially anaerobic conditions absorption of the carbon dioxide produced no effect upon nitrification in soil, either of oil cake or of ammonium sulphate. . . . Complete nitrification of ammonium sulphate took place under semianaerobic conditions in which no nitrification of oil cake occurred. . . .

"It was found that salts of some of the heavy metals, such as copper, had a decided influence in neutralizing the toxic action toward seedlings of extracts of soils kept under anaerobic conditions."

In studies of nitrification "grass has been found to prevent entirely accumulation of nitrate in the soil in which it is growing. . . . The optimum amount of organic matter as oil cake containing 5 per cent of nitrogen for nitrification in Pusa soil was found to be about 1 per cent of soil weight. . . . The effect of temperature on nitrification in Pusa soil was tested, the optimum being found to be near 35° C. (95° F.). No nitrate was formed at 40°, nor did nitrification take place in soil which had been kept at 40°, when its temperature was afterwards reduced to 30°."

Experiments to determine the cause of the rise and sudden fall of the rate of carbon dioxide evolution when solid bacterial food-stuffs are added to live soil indicated that this result "was due in part to auto-intoxication by the soil bacteria and in part to the purely physical facts of the case."

The progress of green-manuring experiments and studies of *Azotobacter*, to be reported on elsewhere later, is also noted.

The humification of the constituents of plant organisms and the effect of natural agents upon it. A. TRUCOV (TROUSSEAU) (*Selsk. Khim. i Léséc.*, 247 (1915), Apr., pp. 575-605; abs. in *Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases*, 6 (1915), No. 11, pp. 1453, 1454).—Separate studies of the processes of decomposition of the different constituents of plant organisms and of various mixtures of these constituents, including carbohydrates with proteins, fats, pigments, tannic and emulsifying bodies, gums, glucosids, and organic acids, are reported in an effort to throw light on the genesis of humus. Decomposition was studied both as it occurs on the soil surface and within the soil.

It was found that "lignin, proteins, starch, chlorophyll, tannic bodies, phlobaphenes, some fats, and gums are the direct sources of the humus formed from plant residues on the surface of the soil. Cellulose, hemicellulose, monosaccharids and disaccharids, glucosids, and organic acids (including amido-acids) do not give rise to humus under these circumstances. In view of the considerable amount of proteins contained in bacteria, the possibility of the transformation of the bodies of bacteria into humus may be admitted. In the case of fungi this transformation has been confirmed. . . .

"All the organic constituents utilized by micro-organisms for their nutrition may, by means of their bodies containing nitrogen, become indirect sources of humus. Typical black humus is rapidly formed only when all of the following constituents together take part in its formation: Lignin, proteins, pigments,

and tannins. In a greater length of time it may also be formed by the mixture of lignin and proteins and also by the latter alone. A certain correlation is observed between the artificial and the natural formation of humus, in that in natural surroundings humification is restricted to those organic bodies which readily undergo a similar transformation under the influence of very active chemical agents. Humus can not be always identical in its chemical composition, but must contain the decomposition products of lignin, proteins, pigments, tannic substances, etc."

Humus acids in the light of the results of recent investigations, E. GULLY (*Internat. Mitt. Bodenk.*, 5 (1915), Nos. 3, pp. 232-247; 4, pp. 347-368; *abstr.* in *Ztschr. Angew. Chem.*, 28 (1915), No. 77, *Referatenteil*, p. 487).—The author reviews the work of others bearing on the subject and reports the results of new experiments on the degree of acidity of different substances, including dopplerite and beech leaves.

A comparison of the acidity of the substances before and after extraction of the bases showed evidences of the action of colloids. The results are taken to indicate that all plants contribute to the acidity of humus. No direct relation was found between the acid content of moor substances and the process of peat formation. The acidity stood in inverse proportion to the plant food content. The natural humus acids were found to form neither soluble alkali nor insoluble lime salts. It is thought that the previously formed humus acids in living sphagnum are identical with the so-called humus acids.

Report on experiments with bacterized peat or humogen, F. J. CHITTENDEN (*Jour. Roy. Hort. Soc.*, 41 (1915), No. 2, pp. 305-326, *figs.* 2).—Five series of pot and plat experiments are reported. The purpose was to determine the influence of additions of bacterized peat on the growth of various flowers and vegetables.

It was found that plant growth was greatly and uniformly increased by bacterized peat in the indoor pot experiments, in which the material was used at rates of 1 part of peat to 1, 3, and 7 parts of soil and the soil was watered with a bacterized peat extract. Much less favorable results were obtained in the outdoor plat experiments. In comparative lots 20 tons of barnyard manure per acre gave better results than 1 ton of bacterized peat. The full results were obtained from the use of peat only when the supply of water was abundant. "The results on the whole show that when prepared under the best conditions bacterized peat is capable of acting as a very effective manure."

The effects of radio-active ores and residues on plant life, M. H. F. SUTTON (*Reading, Eng.: Sutton & Sons, 1915, Bul.* 7, pp. 20, *figs.* 9).—This is a report of a second series of experiments conducted during 1915, in which the results of the 1914 experiments (*E. S. R.*, 34, p. 821) are reviewed and the results obtained with nine different radio-active materials when used on tomatoes, potatoes, radishes, lettuce, onions, carrots, vegetable marrows, and spinach beets, and on fruit, roots, foliage, and bulbs are reported.

"The experiments indicate no more hope of the successful employment of radium as an aid to either horticulture or agriculture than did the trials carried out in 1914." It is considered conclusive that the farmer and gardener need look for no material benefit from radium, the chief result having been to emphasize the value of barnyard manure and complete artificial fertilizers.

Experiments with green manures and green manuring on sandy and white moss soils at Flahult, H. VON FEULTZEN (*Svenska Mosskulturför. Tidskr.*, 29 (1915), No. 4-5, pp. 326-338, *figs.* 3).—Experiments on the reclamation of sandy and white moss soils deficient in plant food, especially nitrogen, and having a low moisture retaining capacity are reported. The rotation included rye, potatoes, carrots, and different legumes.

Blue lupines gave the most favorable results, being better than yellow lupines. Alfalfa appeared to be a failure as a green manure on these soils. The data from several years' experiments are reported in tabular form.

The displacement by water of the nitrogenous and mineral material contained in leaves, G. Annaë (*Bul. Soc. Chim. France*, 4. ser., 17 (1915), No. 23, pp. 429-441; *abs. in Chem. Abs.*, 10 (1916), No. 6, p. 796).--Experiments with chestnut leaves are reported.

* Analyses of 100 leaves on October 17 and of 100 more on the following April 21, which had wintered on the ground, showed a loss of 7.5 per cent of the nitrogen, 67.4 per cent of the phosphoric acid, and 87.7 per cent of the potash. Dead leaves after wintering in piles on the ground were found to contain about twice as much nitrogen and about the same amount of phosphoric acid as a good farm manure. The nitrogen did not nitrify as readily as that of manure.

To determine the influence of water alone, leaves were covered with water together with a few drops of formalin. The solution was decanted, replaced by more water, and the solutions analyzed. The last portion, after 255 days extraction, contained 6.27 per cent of the total nitrogen, 74.14 per cent of the total phosphoric acid, and 94.58 per cent of the potash. This is taken to indicate that the nitrogen of the leaves exists as a protein which does not readily hydrolyze. It was further observed that the younger the leaf, the larger were the percentages of nitrogen, phosphoric acid, and potash extracted in the first week.

The same experiments were conducted with reference to sulphur, lime, and magnesia content. After immersion for one month in water it was found that 56.8 per cent of the total sulphur, 50.72 per cent of the magnesia, and only 20.03 per cent of the lime were displaced.

Report on ten years' experiments with sewage fertilizers, KUHNERT (*Mitt. Deut. Landw. Gesell.*, 31 (1916), No. 16, pp. 253-258).--Field experiments on several different German experimental fields of swampy sand soil with cabbages, rye, oats, potatoes, and clover to determine the fertilizing value of stable manure, peat and sewage mixture, and soil and sewage mixture when applied in amounts of about 22 tons, 18 tons, and 13 tons per acre are reported. The peat and sewage mixture used in one case contained 0.44 per cent total nitrogen, 0.22 per cent water-soluble phosphoric acid, and 0.35 per cent potash; and in a second case 0.65 per cent total nitrogen, 0.28 per cent water-soluble phosphoric acid, and 0.31 per cent potash. The soil and sewage mixture used contained 0.39 per cent total nitrogen, 0.01 per cent soluble phosphoric acid, and 0.11 per cent potash.

In all cases the plats treated with sewage fertilizers produced an increase in crop over the unfertilized plats, in some cases exceeded the plats fertilized with stable manure, and gave on the average as good results as plats receiving complete artificial fertilization. It is considered inadvisable and unprofitable to use raw sewage for a fertilizer. Mixing with peat or earth in amounts double the amounts of sewage used was found to be a better practice.

Solubility of plant-food elements as modified by fertilizers, C. A. JESSEN (*Jour. Amer. Soc. Agron.*, 8 (1916), No. 2, pp. 190-195).--Continuing previous work (E. S. R., 35, p. 321), experiments on a field of sandy loam soil, supporting a growth of sugar beets but which had previously been in alfalfa for several years are reported, showing the seasonal changes in the water-soluble nutritive constituents in the soil and the effect of fertilizers on the amounts of the various elements recovered. The fertilizers were applied at the following rates per acre: "Nothing; nitrate of soda, 300 lbs. at time of planting and 300 lbs. when the beets were thinned; calcium cyanamid, 300 lbs.; superphosphate, 500 lbs.; bone meal, 500 lbs.; factory waste lime, 15 tons; composted manure, 14

tons; ordinary dry yard manure, 14 tons; and yard manure, 14 tons plus 300 lbs. ammonium sulphate."

It was found that "the plats receiving composted manure showed nearly twice as much water-soluble potash in the surface foot as any of the other plats. The seasonal averages of this element were not influenced by any other fertilizer treatment. There was a general decrease in the quantity of water-soluble potash from the middle of May till about the middle of July. After that time, the quantity increased to approximately the amount found earlier in the season.

"Plats receiving nitrate, superphosphate, and composted manure all showed less water-soluble phosphoric acid than the checks. None of the fertilizer treatments resulted in a marked increase in water-soluble phosphates, though cyanamid, bone meal, and manure plus ammonium sulphate caused a small increase. The variation in water-soluble phosphorus from week to week was less than that of any other element measured.

"Taking account of the sulphur added in the various fertilizers, none of the treatments apparently had any marked influence in rendering the sulphates in the soil more soluble in water. There was a decrease in the amount of soluble sulphates from the early part of the season till the latter part of July, corresponding in general to the seasonal decrease in soluble potash.

"The amounts of water-soluble manganese were very small and disappeared entirely after the middle of June. The plats receiving nitrate, composted manure, waste lime, and manure plus ammonium sulphate, showed the highest manganese content. It is remarked . . . that the sugar beets grown on plats showing the highest amounts of water-soluble manganese and sulphur gave the highest yields and the most sugar per acre."

New experiments on the action of lime nitrogen. A. STUTZER and W. HAUTP (*Jour. Landw.*, 63 (1915), No. 4, pp. 385-387).—Pot experiments with oats and white mustard on soil consisting of equal parts of loam and quartz sand are reported, the purpose of which was to determine the fertilizing value of the nitrogen compounds of lime nitrogen which were insoluble in water. The residue resulting from treatment of lime nitrogen with an excess of water and with sufficient hydrochloric acid to produce an acid reaction in the solution was used. One kg. of lime nitrogen yielded 24.1 gm. of insoluble residue containing about 7 per cent of nitrogen. This was used in amounts equivalent to 0.8 gals. of nitrogen per pot.

It was found that the nitrogen was well utilized by mustard, the utilization in one case being unexpectedly high. The same results were obtained with oats. These results are taken to indicate that this part of the lime nitrogen does not decrease crop yield.

Accumulated fertility in grass land in consequence of phosphatic manuring. II, W. SOMERVILLE (*Jour. Bd. Agr. [London]*, 22 (1916), No. 12, pp. 1201-1209, pl. 1).—In a second report on these experiments (E. S. R., 32, p. 331), it was found that "when basic slag is used on grass land the increase of herbage, or of meat or milk, does not represent the whole of the benefits. Concurrently with such increase there is improvement in the fertility of the soil. . . . The extent of the accumulation of fertility depends on the amount of slag used, on the period of time during which it acts, and on the way in which the land responds to it. . . . The fertility that is accumulated seems to be largely due to nitrogen stored up by leguminous plants, though increase in nonleguminous humus is probably not without influence. Residues of slag appear also to play some small part in the result."

The action of potash fertilization on the water requirements of plants and on the water content of soil. C. VON SEELHORST (*Jour. Landw.*, 63 (1915), No. 4, pp. 345-356).—The work of others bearing on the subject is reviewed and

pot experiments, in which 1 gm. each of kainit and a 40 per cent potash salt were added to 100 gm. of soil, are reported.

The results obtained by others and the original experimental results are taken to indicate that potash fertilization decreases the water requirement of plants. Potash fertilization with kainit on a large scale, however, does not increase the moisture content of soil in the summer months, since the moisture absorbed from moist air by the hygroscopic salt is again evaporated from the soil into dry air.

The hygroscopicity of various potassium fertilizer salts, H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr.*, 29 (1915), No. 4-5, pp. 382-401, figs. 3).—Experiments with kainit and 20, 37, and 40 per cent potassium salts are reported.

Kainit and the 20 and 37 per cent salts, after storage from three to six months in sacks, contained a few lumps, and the 40 per cent salt contained a few lumps not passing the 4 mm. sieve. After nine months' storage in sacks, kainit was damp at the top and quite wet at the bottom. It formed one lump which was, however, dry. The same was observed with the 20 per cent salt. The 37 per cent salt stood in small damp lumps. The 40 per cent salt stood in even smaller lumps, but was all damp. In all cases the sacks were wet and had to be cut open.

Tests of the availability of different grades of ground limestone, L. B. BROUGHTON, R. C. WILLIAMS, and G. S. FRAZER (*Maryland Sta. Bul.* 193 (1916), pp. 31-45).—Experiments on the solubility of limestone and oyster shells of different grades of fineness in water and water charged with carbon dioxide and in a soil solution, and experiments on $\frac{1}{2}$ -acre plots of sandy loam soil to determine the influence of different sizes of ground limestone and oyster shells on wheat and crimson clover, are reported.

It was found that "ground limestone and oyster shells of different degrees of fineness vary in their degree of solubility in water and water charged with carbon dioxide [and in soil solution] according to the fineness of the material. . . . In order to furnish as much soluble calcium, by the use of ground stone or ground shells to a soil as calcium oxide will furnish, the stone or shells must be ground so that at least 90 per cent will pass an 80-mesh sieve. . . . Ground limestone, when ground to pass an 80-mesh sieve, gives yields equal to and sometimes greater than calcium oxide."

It is concluded that "better results will be obtained by using calcium oxide (lime) or limestone and oyster shells ground to pass an 80-mesh sieve than by using a coarser grade of limestone or shells. However, marked increases will be noted by the use of large quantities of coarse material, due in a large measure to the fine material that is found in any limestone after it has been ground."

Tabulated analyses of commercial fertilizers, W. FREAR (*Penn. Dept. Agr. Bul.* 277 (1916), pp. 55).—This bulletin contains the results of actual and guaranteed analyses and estimated valuations of 371 samples of fertilizers and fertilizing materials collected for inspection in Pennsylvania from August 1 to December 31, 1915.

[List of fertilizer and lime manufacturers and importers and their products] (*Penn. Dept. Agr. Bul.* 275 (1916), pp. 42).—This bulletin contains a list of 184 fertilizer and lime manufacturers and importers and licensed brands of their products, together with the text of the Pennsylvania fertilizer law.

The international movement of fertilizers and chemical products useful to agriculture (*Internat. Inst. Agr. Rome, Internat. Crop Rpt. and Agr. Statis.* 7 (1916), No. 3, pp. 177-221).—This review, issued in March, 1916, is the fourth of a series (*R. S. R.*, 34, p. 426) and gives figures for the fertilizer production and trade for 1913, 1914, and 1915. Data are also given for imports and exports of sulphur for the different countries and for the production of copper

sulphate in Europe and North America. No figures are given relating to the production of potash salts in Germany, the tables showing only those amounts delivered for internal trade and export as fixed by the law of 1910.

The wholesale prices of raw phosphate remained practically unchanged in the United States during the seven months ended with February, 1915 (prices are not given for superphosphates). Prices of potash salts were prohibitive from the standpoint of their use as fertilizers during the half year ended with January, 1916. There was a steady increase in the price of sodium nitrate during the same period. Prices of ammonium sulphate fluctuated, but were substantially the same at the end as at the beginning of the half year.

A bibliography of 445 references to recent literature on the subject of fertilizers is appended.

AGRICULTURAL BOTANY.

Annual periodicity in plants, G. LAKON (*Naturw. Ztschr. Forst u. Landw.*, 13 (1915), No. 2-3, pp. 85-101).—From investigations discussed the author concludes that an inherent annual periodicity in woody plants does not exist as such, but that this, as seen in nature, is the result rather of external influences on the tree. The plant is claimed to have the capability to grow continuously under certain conditions, or under other conditions to experience a resting period.

Rhythmic alternation of growth and rest in plants, G. LAKON (*Biol. Centbl.*, 35 (1915), No. 10, pp. 401-471).—The article above noted has been followed up with a more extended discussion and bibliography. The evidence is claimed to support the conclusion that the development of periodicity, like that of the plant itself, is dependent principally upon the occurrence of external conditions favorable thereto.

Energy transformations during the germination of wheat grains, LUCIE C. DOYER (*K. Akad. Wetensch. Amsterdam, Proc. Sect. Sci.*, 17 (1914), pt. 1, pp. 62-70).—From investigations on germinating wheat, the author has concluded that the loss of energy and evolution of heat both show a great increase during the germination of wheat grains, especially about the third day. The evolution of heat depends greatly on the surrounding temperature, the optimum being about 35° C. (95° F.). The total loss of energy during germination at 20° exceeds the loss of energy by evolution of heat at the same temperature.

The influence of frost and light on the germination of seeds, W. KIMMEL (*Naturw. Ztschr. Forst u. Landw.*, 13 (1915), No. 10, pp. 435-468).—Later results are given of experimentation previously noted (*E. S. R.*, 33, p. 343) testing influences bearing on germination, particularly the effect of frost and light as shown by representatives of a large number of plant families, together with a bibliography of the subject.

Germination as related to illumination, E. LEHMANN (*Ztschr. Bot.*, 7 (1915), No. 9, pp. 560-580).—The author has followed up the contribution of Gassner (*E. S. R.*, 35, p. 524), with a critical review of recent literature on the relation of light to germination. Some experimental data in tabular form obtained recently by Ottenwälder in connection with the author are included.

On the mutual influence of phototropic and geotropic reactions in plants, C. E. B. BREMEKAMP (*K. Akad. Wetensch. Amsterdam, Verh. Wis en Natuurh. Afdel.*, 23 (1914-15), pt. 2, pp. 1241-1255; also in *iditto*, *Proc. Sect. Sci.*, 17 (1914-15), pt. 2, pp. 1278-1291).—The tests here described refer to the summation of phototropic and geotropic curvatures, changes in the phototropic and geotropic reactions under the influence of light, and changes in the geotropic and phototropic reactions under the influence of gravity.

It is stated that the reactions of *Avena* to gravitational stimuli and to light stimulation of small intensity do not noticeably influence each other. By varying the duration and the intensity of illumination, modifications were produced; namely, the reversal of the direction of curvature and a change in the rate of reaction.

Determination of cell sap concentration by the freezing point method, G. J. BOUVOCOS and M. M. MCCOOL (*Jour. Amer. Soc. Agron.*, 8 (1916), No. 1, p. 50).—In the present brief note attention is called to the fact that as a result of the successful application of the freezing-point method in a study previously reported (*E. S. R.*, 34, p. 721), this method can now be employed to investigate many other problems. It is stated that the determination of the concentration of the plant cell sap can be accomplished directly in the plant without extracting it by crushing the plant tissue, placing it in the freezing tube, inserting the thermometer, and following the procedure described. The results of the considerable work already done have fulfilled anticipations, inasmuch as the concentration of the cell sap is greater when determined directly in the plant than after extraction.

The transpiration coefficients of cultivated plants, N. TULAIKOV (ТОУЛАЙКОВ) (*Zhur. Opytn. Agron.*, 16 (1915), No. 1, pp. 36-76, figs. 4; *abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases*, 6 (1915), No. 6, pp. 813-815).—This is an account of the study at the Besentchuk Agricultural Experiment Station during 1910 to 1914, in the culture house and in the open, of the transpiration coefficient or the amount of water necessary to form a unit of dry matter.

The results, which are tabulated, are considered to show that the variations of the transpiration coefficient of a given plant are sometimes larger in different years than for different species in the same year. The numerical coefficient in the open was about twice as large as that in the culture house, but its volume depends upon meteorological conditions in the same way as in the former case. Early sowing gives a large crop and a low transpiration coefficient, late sowing a high transpiration coefficient but a lessened crop. The coefficients of wheat and oats in rows are lower than in the same crops sown broadcast. In 1914 the largest crops of summer wheat and oats corresponded to the lowest water consumption.

Assimilation of carbon dioxide by plants, P. N. RAIKOW (*Chem. Ztg.*, 39 (1915), No. 105, pp. 657-659; *abs. in Jour. Chem. Soc. [London]*, 103 (1915), No. 637, 1, pp. 1047, 1048).—A theory herein set forth intended to explain the assimilation of carbon dioxide by plants is based largely on the properties of chlorophyll and the presence of an oxonium compound. According to this view, the oxygen liberated is probably derived one-half from carbon dioxide and one-half from water.

Importance of glycogen and starch as intermediate products in the transformations induced by certain organisms, H. I. WATERMAN (*Chem. Weekbl.*, 12 (1915), No. 24, pp. 552-556; *abs. in Jour. Chem. Soc. [London]*, 103 (1915), No. 638, 1, p. 630).—Details are given of an investigation of the percentages of invert sugar, sucrose, and starch present in bananas dried at temperatures between 45° and 105° C.

Recent studies on the chemical and histological characters of radish cultivated in the presence of sugar, M. MOLLARD (*Rev. Gén. Bot.*, 27 (1915), No. 218, pp. 161-168, pls. 2, figs. 2).—Studies pursuant to those previously reported (*E. S. R.*, 19, p. 932), employing sugar solutions of different strengths, show resulting alterations, which are described, in tissue structure and cell content.

The relation between amylase and sugar content in resting potato tubers, J. BODNÁR (*Kísérlet. Közlem.*, 18 (1915), No. 4, pp. 788-795, No. 1).—This work is said to have shown the presence of maltase in resting potato tubers. The activity of amylase in resting tubers shows a correspondence with the presence of nonreducing and total sugars, certain exceptions being noted. It is stated that tubers which possess amylase of high activity either produce much sugar or exhibit intensive respiration.

Zymase and carboxylase in potato and sugar beet, J. BODNÁR (*Bot. Közlem.* [Budapest], 14 (1915), No. 3-4, pp. 122-124; *abs. in Bot. Centbl.*, 129 (1915), No. 23, pp. 597, 598).—From potato tubers and beet roots the author was able to obtain zymase in stable and active condition. In its presence the bacteria in diseased plants changed alcohol to acetic acid.

Oxidation of alcohol by seedlings, W. ZALESKI (*Biochem. Ztschr.*, 69 (1915), No. 3-4, pp. 289-293; *abs. in Jour. Chem. Soc. [London]*, 103 (1915), No. 633, I, p. 630).—In pursuance of former work (E. S. R., 23, p. 428), the author reports the results of his recent studies on cereal and legume seedlings. This is claimed to support the view that alcohol is oxidized in the growth of these seedlings under the conditions here employed. It is not claimed, however, to have been shown that alcohol is a normal intermediate product of plant metabolism.

Protein transformations in yeast.—II. Influence of the medium on protein formation, W. ZALESKI and W. SCHATALOFF (*Biochem. Ztschr.*, 69 (1915), No. 3-4, pp. 294-304).—Information given previously (E. S. R., 31, p. 223) regarding the influence of aldehyde on post-mortem changes in yeast has been followed up with a detailed account of studies on the effects in this connection of alcohols and phenols, of the relation of the medium, and of the influence exerted by other substances. Some of the work is still in progress and caution is suggested regarding broad generalizations in this connection.

The influence of nitrates on the development of root tubercles, A. J. EYAR (*Jour. Dept. Agr. Victoria*, 13 (1915), No. 12, pp. 759, 760).—In order to test the statement, frequently made, that the addition of soluble nitrates to the soil decreases by a kind of compensatory action the formation of root tubercles by legumes, experiments were carried out with *Vicia faba* in double and in single rows, employing sodium and potassium nitrates. Allowing for vitiation of the results by heavy rainfall in case of the double rows, it is concluded that although the nitrates used did not appreciably diminish the formation of root tubercles, their use as manures in the case in question would have been highly unprofitable, the plants being able to gain all the nitrogen they required from supplies already present in the soil.

The influence of manganese on the growth and ash composition of potato, Š. SJIFERT (*Věstník 5. Slez. Čes. Lék. Přír.*, 1915, p. 411; *abs. in Bot. Centbl.*, 129 (1915), No. 15, pp. 376, 377).—It is stated that the use of manganese results in an increase of the potato crop and in the nitrogen content thereof, but in a decrease of starch. Though sulphates were present in the fertilizer, very little sulphur trioxide was to be found in the ash.

The occurrence of hematoid iron compounds in plants, I, II, G. GOLZ (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat.*, 5, ser., 24 (1915), I, No. 12, pp. 1239-1243; II, No. 6, pp. 289-294).—Organic compounds of iron were found so generally distributed in very diverse groups of plants as to suggest their universal occurrence in this connection. The necessity for more intimate study of the part played by iron in the physiology of respiration is suggested.

Chondriosomes in fungi and algæ, A. GUTILLIERMOND (*Rev. Gén. Bot.*, 27 (1915), Nos. 319, pp. 193-207, pls. 2, fig. 1; 320, pp. 236-253, pls. 2; 321, pp. 271-288, pls. 3, fig. 1; 322, pp. 297-315, figs. 2).—Continuing work previously noted (E. S. R., 32, p. 524), the author states that chondriosomes have been found in a large number of fungi, in which they appear to be generally present. In some algæ it was impossible to demonstrate their presence, but the chloroplast, which is here highly differentiated, shows some chemical and histological characters proper to mitochondria and may consist of fine fibrillar mitochondrial substance, as physiologically it seems to play the rôle appropriate thereto and may be considered as a sort of mitochondrial reticulum. In the Cyanophyceæ the chondriosome, as such, appears to be completely wanting, but it appears to be more or less completely replaced functionally by the nucleus. The physiological rôle of the chondriosome appears clearly evident in case of fungi, as they produce vesicles which are claimed to be absolutely analogous to those which produce starch in the higher plants.

The bibliography appended includes titles of 19 contributions by the author.

Division in mitochondria and their relations with the phenomena of secretion, F. MOREAU (*Compt. Rend. Soc. Biol. [Paris]*, 78 (1915), No. 6, pp. 143, 144; *abs. in Bot. Centbl.*, 129 (1915), No. 23, pp. 593, 594).—Considering the three views regarding the origin of mitochondria which are more commonly held, namely, that they result directly from a protoplasmic differentiation, that they are of nuclear origin, and that they arise from preexisting mitochondria, the author prefers the last mentioned, citing studies more particularly relating to certain algæ and fungi. It is held that each chondriosome arises from one previously existing, but that mitochondria destined for division do not secrete, and those which do secrete do not divide.

The formation of crystalloids of mucorin in mitochondria, F. MOREAU (*Compt. Rend. Soc. Biol. [Paris]*, 78 (1915), No. 7, pp. 171, 172; *abs. in Bot. Centbl.*, 129 (1915), No. 23, p. 594).—It is stated that in portions of *Sporodinia grandis* and *Rhizopus nigricans* mucorin crystalloids are observed to originate and increase in granular mitochondria.

Internal uredinia, J. F. ADAMS (*Mycologia*, 8 (1916), No. 3, pp. 181, 182, pl. 1).—Noting instances previously recorded of deviations from normal development, the author reports another aberrant case in the production of internal uredinia by *Nigredo caryophyllina* (*Uromyces caryophyllinus*) in the leaves of *Dianthus caryophyllus* in the greenhouse of the Pennsylvania State College. The deviation here noted from the usual method is thought to represent an abnormal rather than a typical condition.

Asexual hybridization, L. DANIEL (*Rev. Gén. Bot.*, 26 (1914), No. 308, pp. 305-341, figs. 8; 27 (1915), Nos. 313, pp. 22-29, figs. 10; 314, pp. 33-49, pls. 3, figs. 6).—After a review of observation and opinion regarding graft hybrids, the author reports on his own more recent observations with four asexual graft hybrids. These have been studied somewhat in detail as regards their characters, both external and internal, at different stages. It is considered as of theoretical and practical importance that occasionally this form of hybridization gives rise to characters not previously possessed by either of the stocks concerned in its formation.

Variation in *Cosmos bipinnatus*, B. LONGO (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat.*, 5. ser., 24 (1915), II, No. 9, pp. 408-410).—A descriptive account is given of the variation observed for two consecutive years in the generations of *C. bipinnatus*.

Seashore thicket formation by *Prunus spinosa*, H. DEVAUX (*Rev. Gén. Bot.*, 27 (1915), No. 320, pp. 225-235, pl. 1, figs. 2).—A description is given of some

striking effects as regards position and contour produced by wind action in connection with growth and death in thickets of *P. spinosa* in exposed situations on the seashore.

Differences in resistance of plants to injurious influences, F. STRANÁK (*Věstník 5. Sjez. Čes. Lék. Přir.*, 1915, p. 425; *abs. in Bot. Centbl.*, 129 (1915), No. 15, p. 378).—Important phases of the resistance of plants to attack are their anatomical structure (as mechanical tissue or impregnation with silica), morphological characters (as thickness of stems in cereals), chemical constituents of the plant body (as silica or lime), and vegetative period.

The effects of illuminating gas on plants, P. SORAUER (*Landw. Jahrb.*, 48 (1915), No. 2, pp. 279–312, pl. 1, figs. 2).—Previous investigations (E. S. R., 26, p. 532) have been followed up with a study of the various effects of illuminating gas in the soil on several sorts of wild or cultivated plants, largely trees. The results are detailed as regards the influences noted, including reactions by the plants. It is thought that, while a number of indications are found which, taken together, may be considered as characteristic of root injury by gas, no single symptom, as for example changes in leaf coloration, can be depended upon as a certain indication of gas injury to roots.

The influence of sulphur dioxide on plants, R. TENKA (*Věstník 5. Sjez. Čes. Lék. Přir.*, 1915, p. 431; *abs. in Bot. Centbl.*, 129 (1915), No. 15, p. 378).—Plants are said to take up into their active green tissue sulphur dioxide in different proportions. This is thought to form sulphurous or sulphuric acid and to interfere greatly with the formation of vegetable matter.

Secretion by roots of substances toxic to plants, M. MOLLIARD (*Rev. Gén. Bot.*, 27 (1915), No. 322, pp. 289–296, pl. 1).—Work previously reported (E. S. R., 30, p. 522) has been followed up by further tests with peas. These are said to show that the plants excrete substances which prove toxic to plants grown thereafter in the medium previously used. The effect was increased after the medium had been twice used.

Injurious effects from ivy growing on trees, C. VON TUBERF (*Naturw. Ztschr. Forst. u. Landw.*, 13 (1915), No. 10, pp. 476–481, figs. 5).—This is a further account, with discussion, of stem constrictions of plants (E. S. R., 31, p. 343).

FIELD CROPS.

Field crops, D. N. PRIANISHNIKOFF (*Ustnoe Zemledelie. Moscov: V. Rikhter*, 1914, pp. 513–15, pls. 144, figs. 2).—This work deals with cereal, root, and leguminous crops, together with other plants grown for oil, fiber, dye, and spice production. Attention is also given to tobacco and other plants used for their narcotic effect. The culture and uses of the different crops are considered in detail and the control of diseases and insect enemies is outlined. The work has reference to the culture of the different crops in Russia.

[Irrigation experiments at Bromberg] (*Jahresber. Kaiser Wilhelms Inst. Landw. Bromberg*, 1914, pp. 38–50).—Potatoes were given 30, 140, and 160 mm. (1.2, 5.6, and 6.4 in.) of irrigation water, applied by sprinkling, in addition to a rainfall of 195 mm. during the growing season. A forage variety, Gertrude, yielded 13,209 lbs. of tubers per acre without irrigation and 15,269 lbs., 15,440 lbs., and 19,099 lbs. per acre when receiving 30, 140, and 160 mm. of irrigation water, respectively. Magnum Bonum, a table variety, yielded 4,462 lbs. with only the natural rainfall and 10,710 lbs. and 10,978 lbs. per acre with 140 and 160 mm. of irrigation water, respectively. On the assumption that both rain and irrigation water was completely used by the plants, it is pointed out that it required on the average of all tests 556 lbs. of water to produce 1 lb.

of dry substance in the tuber. In another experiment, conducted on a heavier soil, it was found that irrigation did not increase the yield of tubers to the same extent as in the experiments just described, which were conducted on sandy soil, and the starch content also was increased to only a very limited extent. The percentage of large-sized tubers in the crop, however, appeared to have been increased considerably as the result of irrigation.

In addition to these trials an experiment was conducted with the use of different quantities of waste water from potash works applied with the irrigation water. Although as high as 1.2 kg. of chlorine were given per cubic meter of water applied, no injurious effects on the growth and yield of the potatoes was observed, but the foliage was considerably lighter in color than the foliage of the plants irrigated with pure water and the crop ripened about three weeks earlier.

Sugar beets received a natural precipitation of 237 mm. from May 1 to September 30, and were given in addition on certain plats either 130 or 220 mm. of irrigation water. The plat irrigated with 130 mm. produced 3,300 lbs. of beets and 3,213 lbs. of leaves more per acre than the plat not irrigated. The use of 220 mm. of water apparently reduced the yield of beets and leaves as compared with the application of 130 mm. The results indicated that it required an average of 334 lbs. of water to produce 1 lb. of dry matter in the beets and foliage.

Irrigation of meadows on light sandy soil by the furrowing, flooding, and furrow-gravity methods gave very satisfactory results, the best yield being secured with furrow-gravity irrigation.

Ten years of variety tests at Dickopshof, A. RICHARDSEN (*Landw. Jahrb.*, 38 (1915), No. 3, pp. 331-427).—The soil conditions of the experiment field are described, data with reference to the weather conditions for the different years are tabulated, the crop rotations followed are outlined, and the methods of conducting the variety tests with winter and spring wheats, winter rye, oats, barley, sugar beets, fodder beets, ruta-bagas, and potatoes are discussed. The soil devoted to these tests is described as a deep loam with favorable physical characters, although not especially satisfactory from a chemical point of view. The meteorological observations showed a ten-year average of 9.6° C. (49.1° F.) as the mean daily temperature for the year, an annual sunshine total of 1,107 hours, and an annual precipitation of 635 mm. (27.8 in.). The results are tabulated in detail for the different years and are summarized for different periods.

Of three winter wheat varieties grown for seven years, Strube Club gave an average yield of 3,321 kg. of grain and 5,999 kg. of straw per hectare (49.4 bu. and 5,339 lbs. per acre, respectively). Mette Club yielded on the average 3,161 kg. of grain and 5,830 kg. of straw per hectare. Strube Club also stood first among the varieties grown for periods of six, five, and four years, but ranked second—Mette Club standing first—among 11 varieties tested from 1911 to 1913, inclusive. In a seven-year test the grain produced by the two varieties represented an average of 35.4 per cent of the total yield, while the average liter weight was 780.3 gm., and the average weight of 1,000 kernels 37.709 gm.

From the results secured with spring wheat it is concluded that for the soil conditions of the test, Heine Japhet and Rimpau Red Schlanstedt are of equal value, and apparently superior to the other varieties tested, while Kraft Bordeaux, Wohltmann Blue Dame, and Iden are considered promising sorts approaching each other in yielding capacity. In one seven-year test Rimpau Red Schlanstedt, the leading variety, yielded on an average 2,927 kg. of grain and 5,815 kg. of straw per hectare. As compared with the winter wheat varieties, the spring wheat varieties gave a higher average weight per liter

and per 1,000 kernels, but the average percentage of grain as based on the total yield of grain and straw was higher with the winter wheat varieties.

The test of varieties of winter rye showed Lochow Petkus as the leading sort, with Himmel Champagne ranking next, and Sperling Green Kerneled, Kraft Zeeland, and Rümker Yellow Kerneled as promising varieties. In a nine-year test Lochow Petkus produced on an average 2,775 kg. of grain and 5,996 kg. of straw per hectare, while Himmel Champagne yielded 2,630 kg. of grain and 5,674 kg. of straw, but ranked above the other variety in average percentage of grain, liter weight, and 1,000-kernel weight.

The leading variety of oats in tests carried on for six, five, and four years was Strube Schlanstedt, followed by Svalöf Goldregen and Leutewitz Yellow. In the three and two year tests all these varieties fell below Lochow Yellow and Svalöf Siegeshafer. In the six-year test the varieties above mentioned, yielded an average of 3,423 kg. of grain and 4,718 kg. of straw per hectare, the proportion of grain to total production being 42.05 per cent, the liter weight 513 gm., the 1,000-kernel weight 28.081 gm., and the proportion of hull in the grain 25.09 per cent.

Varities of brewing barley were tested for only three years. The average grain production was in favor of Improved Pfalz, yielding 3,821 kg. of grain and 4,804 kg. of straw per hectare. This variety also ranked first in proportion of grain to total yield with 44.45 per cent, in liter weight with 630.5 gm., and in 1,000-kernel weight with 48.39 gm. The average protein content was 11.55 per cent which, although rather high, was nevertheless lower than in any other variety. Nole Bohemia and Heil Frankengerste stood next in value.

The data secured with varieties of sugar beets indicated in general that a decrease in beet production was associated with an increase in leaf production, not only relatively but also absolutely and as a rule with an increasing percentage of sugar. As a result of this relationship it is pointed out that the sugar production per hectare fluctuates much less than the beet production and the percentage of sugar content. In beet yield the variety Friedrichswerth, among four varieties tested for eight years, ranked first with 42,392 kg. of beets and 29,882 kg. of leaves per hectare. The average sugar content of the beet, 16.22 per cent, was lower than in the other varieties but the average sugar production per hectare, 6,876 kg., was the highest. This was also generally true of the results secured in the tests of shorter duration and with a larger number of varieties. For sugar production the varieties Breustedt, Schobbert Specialty 1, and Schobbert Ideal 1 ranked next to Friedrichswerth.

The results with varieties of fodder beets showed that a decrease in beet yield was accompanied by an increase in leaf production, not only in the percentage relation of the leaves to the beet, but also in the production per hectare, and also in general by an increase in dry matter content. It is pointed out that for this reason the dry matter yield per hectare varies less than the beet yield and the percentage dry matter content. Of four varieties tested for nine years, the leading variety, Yellow Eckendorf, yielded an average of 85,913 kg. of beets and 10,966 kg. of leaves per hectare. The average dry matter content of the beet was 11.17 per cent. While this variety was the heaviest yielder of beets, it fell behind the other sorts in dry matter content and dry matter production, the average for the four varieties being 13.52 per cent and 10,314 kg. per hectare respectively. Two varieties, Durana and Veni Vidi Vici, stood well above the average in dry matter production per hectare.

The test with rutabagus was conducted for only three years and limited to only three varieties. The leading variety, Remy Improved Altmark Giant, yielded 65,000 kg. of beets per hectare with a dry matter content of 12.57 per cent.

Study of the root systems of pasture plants on the moor soils of the experiment fields at Flahult and Torestorp, H. OSVALD (*Mitt. Ver. Förd. Moorkultur Deut. Reiche*, 34 (1916), No. 4, pp. 62-76, figs. 10).—Observations made on the depth and distribution of the root systems of white clover, timothy, meadow foxtail, Kentucky bluegrass, meadow fescue, red fescue, and orchard grass growing on lowland and upland moor soils were supplemented by studies of the root anatomy.

On the upland moor meadows at Flahult a dense and heavy root growth occurred in the upper 5 cm. (2 in.), in the next 25 cm. the growth was very thin, while below 30 cm. practically no roots were found. The lowland moor meadows of Torestorp showed a dense and heavy root development in the upper 15 to 20 cm. which gradually became thinner as it extended to the depth of 45 cm.

The results of the anatomical studies indicated that roots from moor soils are less densely constructed, have larger intercellular spaces, and lignify more slowly than roots produced in sandy soil. The larger intercellular spaces which always occur in such grasses as meadow foxtail, and meadow fescue, and timothy are produced much earlier on moor soils and often are found even in very young roots. This is considered due to the inadequate supply of oxygen in the soil and this behavior of the plant as an effort on its part to provide aeration. The absence of root nodules on clover is regarded as further evidence of the lack of oxygen in the soil. On the upland moor soils at Flahult, nodules are found only in the upper 2 or 3 centimeters. The results are taken as showing plainly that in moor soils only a very thin surface layer serves as the source of moisture and nutrients to meadow plants.

Several methods of laying down cultivated land to meadow, S. RHOON (*K. Landtbr. Akad. Handl. och. Tidskr.*, 54 (1915), No. 7, pp. 569-582; *Meddel. Zentralanst. Försöksv. Jordbruksområdet*, No. 115 (1915), pp. 16).—Three different methods of seeding cultivated land to timothy and clover were compared. The seed mixture used consisted of 3 kg. of red clover, 6 kg. of alsike clover, and 21 kg. of timothy per hectare (2.67, 5.34, and 18.69 lbs. per acre). In all cases oats was used as a nurse crop. In one instance the clover and timothy seed was mixed with the oats and the whole sown on smoothly harrowed soil at the rate of 175 kg. per hectare; in another instance the seed mixture was sown on smoothly harrowed land before the nurse crop; and in the third on unharrowed land and after the nurse crop, the land being then smoothed down with the harrow.

The best results were obtained from sowing the seed mixture before the nurse crop. It was also found that covering the clover and grass seed not more than 1.5 cm. (about 0.6 in.) proved most satisfactory.

Corn culture in the Southeastern States, C. H. KYLE (*U. S. Dept. Agr., Farmers' Bul.* 729 (1916), pp. 19, figs. 11).—This publication makes recommendations and suggestions regarding the preparation of land for corn, the use of commercial fertilizers in corn culture, and the planting and cultivation of the crop, applicable mostly to the cotton-growing sections of North Carolina, South Carolina, Georgia, Florida, and Alabama.

Cotton, H. SEMLER (*O Algodão. Rio de Janeiro: Min. Agr., Indus. e Com.*, 1914, pp. 110, figs. 40).—This is a popular treatise on the cotton industry, including a botanical and historical review of the plant, directions for its culture, a description of ginning and other processes of preparing the crop for the market, and statistical notes on the production of cotton for different years and countries.

Observations on the blossoming of hemp, G. HAVAS (*Kisérlet. Közlem.*, 18 (1915), No. 5-6, pp. 908-919, pls. 2, figs. 3).—Hemp plants were grown in the open in 1913 and observations were made every fourth hour from 4 a. m. until 8 p. m. during the blossoming period.

It was observed that in both the staminate and pistillate plants blossoming began at one of the upper nodes on the stem and progressed gradually upward. In vigorous plants with branches from the lower nodes, the progress of blossoming was both upward and downward from the initial blossom, while on the branches themselves the opening of the buds proceeded toward the point. The blossoming of the male plants progressed in such a way that the buds at the ends of the main stem and branches all opened at the same time. The male flowers were found to develop on the leafless portions of the floral axis and the female flowers grouped in pairs in the axils of the leaves. Late-appearing and subordinate branches as a rule bore no flowers. It was further observed that under identical conditions female flowers sometimes reached the receptive stage before the male flowers were ready to supply the pollen. It is stated that in Hungary pollen distribution generally begins during the first half of July, continuing from four to six weeks; that plants may be in blossom from three to four weeks, and that several thousand blossoms may develop on a single plant. The dehiscence in the staminate flowers took place to the greatest extent during the night and early morning. The development of individual buds from blossoming to pollination required about seven hours.

Sorghum vulgare and *S. halepense*, G. C. DUDGEON (*Min. Agr. Egypt, Agr. Prod. No. 1a* (1915), pp. 32).—A general article in encyclopedic form, dealing with *S. vulgare*, under the principal headings of its botanical description, history, cultivation, value of the crop, uses of the grain, leaves, and stalks, areas and yields, prices and returns, food value, sweet sorghum, and broom sorghum. With regard to *S. halepense* only brief notes on botanical relationship and its culture are presented.

Sudan grass, N. SCHMITZ (*Maryland Sta. Bul.* 194 (1916), pp. 47-62, figs. 7).—A general discussion of Sudan grass culture in Maryland is presented and the results of cultural and other tests with the crop are reported.

In 1913 better yields on soils of high and medium fertility, 4.4 and 3.3 tons per acre, respectively, were secured from sowing on June 13 than on earlier and later dates. The average results for three years indicated that under favorable soil conditions 15 lbs. of good seed is sufficient for securing a satisfactory stand. Sudan grass and soy beans as a mixed crop gave the best yield when the Sudan grass was sown at the rate of 15 lbs. and the soy beans at the rate of 6 pks. per acre. The composition of Sudan grass hay, cleaned seed, and straw is given in a table and compared with the composition of other common forage crops. In a digestion test with a bull, coefficients were obtained of 60.6 per cent for dry matter, 35.4 for protein, 41.2 for fat, 50 for crude fiber, and 62 per cent for nitrogen-free extract.

Studies of variation and correlation of weight and sugar content of beets, especially of sugar beets, W. ÖRKEN (*Ztschr. Pflanzenzücht.*, 3 (1915), No. 2, pp. 265-333, figs. 2).—This article deals mainly with the study of correlation between individuals and between the averages of groups of plants. The results obtained are tabulated in detail and discussed at some length.

The conclusions based on the data accumulated are drawn with reference to the present status of sugar-beet breeding. Belief is expressed in the existence of a series of factors influencing the increase in sugar content either directly or indirectly, and in the combination of an increasing number of these factors through the continued selection of beets high in sugar or the selection and reciprocal crossing of families readily transmitting their characters. The breed-

ing of families in which external conditions least affected the sugar content unfavorably is considered to have resulted in the final exclusion of a series of factors which under certain conditions cause a reduction of the sugar content, and this, in conjunction with the gradual fixation of the characters positively determining a higher percentage of sugar, has reduced in the course of time the variability of the sugar content of the beet. The author states that it has been shown repeatedly that the sugar content increases with the intensity of culture, and that for this reason the richest beets are still produced in the long and well established beet-growing centers. He further states that possibilities present themselves to increase the yield of beets as well as the percentage of sugar without detriment to either the one or the other character.

Further conclusions based on the data in hand, but with reference only to heritability, are drawn and presented by T. Roemer, who points out that external conditions have a marked influence on the growth of sugar beets in general, but that the weight of the beet as compared with its sugar content is affected to a greater extent and that its latitude of variation is also the greater. For this reason the increase in weight is regarded as more difficult of achievement than the increase in sugar content, as selection based on weight is more likely to include a higher percentage of nontransmissible characters than selection based on sugar content, and the distinction between heritable and non-heritable variations presents greater difficulties. Attention is called to the fact that the transmission of desirable characters is not the same in either individual plants or in entire families, and that in selection for weight and sugar content a certain influence of the mother beet asserts itself. This is largely determined by the family type, so that the performance of the family is of much greater importance in selection than the performance of the individual. It is stated that weight and sugar content as heritable characters act independent of each other, as inheritance of greater weight and higher sugar content may be coincident with each other or undesirable inheritance of one character may be coupled with desirable inheritance of the other.

The relation between the sugar content and chemical characters in the first generation of an individual mother beet, K. ANDERLIK and J. URBAN (*Ztschr. Zuckerindus. Böhmen*, 40 (1915), No. 3, pp. 107-113).—The results of a study of this question indicated that individual beets of the first generation with the same sugar content may vary within the limits of variation in the weight of the root and leaves. The law of correlations appeared operative to only a very small degree with regard to the average sugar content of the roots and their average weight, but seemed of greater significance in connection with the weight of the leaves, as a higher average sugar content was associated with a lower average weight of leaves. It was found that with the same sugar content in the root, the dry matter in the root and leaves varied within the limits recognized for this factor, but that an average low sugar content was generally accompanied by an average low dry matter content in the root and leaves. The ash content of the root and leaves varied in roots of the same sugar content, but in general rose perceptibly in the leaves with a high average sugar content in the root, and vice versa. The data also indicated that with the increase in the average sugar content of the root, the nitrogen content of the root and leaves increases although only to a limited degree.

Tobacco, H. SEMLER (*O. Fumo. Rio de Janeiro: Min. Agr., Indus. e Com., 1914, pp. 131, figs. 19*).—A popular treatise on tobacco including discussions from the historical, botanical, and cultural standpoints. Notes by A. Caire on the development of tobacco culture, the total yields in different countries, and the quantities exported by Brazil in different years are appended.

Tobacco from Cyprus (*Bul. Imp. Inst. [So. Kensington], 13 (1915), No. 4, pp. 547-550*).—An article describing a number of samples of Turkish tobacco grown in Cyprus, and giving in this connection the chemical composition of two of the samples.

It is pointed out that some of the samples conform with Turkish tobacco as regards size of leaf but that they contain too much moisture for the English market. It is stated that the excess of moisture caused a rapid secondary fermentation in the tobacco resulting in dark patches around the midrib.

Frost and wheat, A. H. COCKAYNE (*Jour. Agr. [New Zeal.], 12 (1916), No. 1, pp. 1-10, figs. 7*).—This article discusses the fertilization of wheat in its relation to frost injury and reports observations made on the effects of a late frost in New Zealand.

In nearly every case the wheat crops which failed to become fertilized as the result of frost injury were autumn sown. It is pointed out that this was not because of the time of sowing but because the crops happened to be in a critical stage when the frost injury occurred. The wheat crops fully fertilized at the time of the frost and whose flowers had closed again were not damaged at all, while spring sown wheat not yet developed to the stage of fertilization was injured more or less where the frost was most severe. These spring sown crops did not show the complete lack of fertilization seen in those that were on the point of flowering when the frost occurred.

Second annual seed laboratory report, 1914-15, W. L. OSWALD (*Minnesota Sta. Bul. 159 (1916), pp. 3-16, figs. 4*).—During the year 8,452 samples were sent in for examination and 125 official samples were collected. The results of purity and germination tests are given in tables.

The use of a sunlight germinator in testing grass and flower seeds gave promising results. It was found that many of the grass seeds germinate best in the light. An experiment in testing the germination of seeds in soil and sand in the greenhouse as compared with the chamber tests in the laboratory showed that in nearly every case the laboratory test gave a somewhat higher percentage of germination than was secured in the soil test in the greenhouse.

Weeds and their identification, E. ATKINSON (*Jour. Agr. [New Zeal.], 12 (1916), No. 1, pp. 32-39, figs. 9*).—Descriptive notes are given on capeweed (*Cryptostemma calandulaceum*), hawkweed (*Crepis capillaris*), and hawkbit (*Leontodon hirtus*), as they occur under New Zealand conditions.

HORTICULTURE.

Plant propagation, M. G. KAINS (*New York: Orange Judd Co., 1916, pp. XIX+322, figs. 214*).—In the present manual and textbook the author has aimed to bring together the latest information on all branches of practical and theoretical plant propagation with the view of making the work valuable both to the professional propagator and to the teacher of plant propagation.

The successive chapters deal with the following subjects: Germination; germination and longevity of seeds; seed testing; potting; propagation by buds—layerage; bottom heat; cuttage; classes of cuttings; graftage—general considerations; is graftage devitalizing; Daniel's experiments and conclusions; general points concerning fruit tree stocks; stock and scion handling; grafting waxes, wound dressings, etc.; methods of grafting; methods of budding; nursery management; laws affecting nursery stock; and suggested practices.

Plant propagation in the Tropics, P. J. WESTER (*Philippine Bur. Agr. Bul. 22 (1916) pp. 87, pls. 12, figs. 40*).—In this bulletin the author first discusses the principles and methods of plant propagation with special reference to their application in the Tropics. Directions are then given for the vegetative propa-

gation of tropical and semitropical fruits, tree planting, orchard management, and the control of the more common diseases and insect pests. A list is given of tropical fruits in the Philippines.

[Ornamental and economic plants in the Botanic Gardens], C. K. BANCROFT (*Rpt. Dept. Sci. and Agr. Brit. Guiana, 1914-15, App. 2, pp. 3-12*).—Notes are given on ornamental and economic plants of various kinds being grown in the Botanic Gardens, Georgetown, British Guiana.

Annual report of the experimental work of the Ganeshkhind Botanical Garden (Poona District) for the year 1914-15, W. BURNS (*Dept. Agr. Bombay, Ann. Rpt. Expt. Work Ganeshkhind Bot. Sta. 1914-15, pp. 47*).—A progress report on cultural experiments, variety tests, and miscellaneous experiments being conducted with fruits and other economic plants in the Ganeshkhind Botanical Garden.

In a college garden, VISCOUNTESS WOLSELEY (*London: John Murray, 1916, pp. XVI+255, pls. 8*).—A popular account of the development and work of the Market Garden School, for women, at Glyde, Sussex.

A second report on the university farm garden, A. L. DACY (*West Virginia Sta. Bul. 156 (1916), pp. 3-22, figs. 5*).—In continuation of a previous report (E. S. R., 33, p. 237) the results secured at the university farm garden for the third season are given, together with an average of the results obtained during the three years 1913 to 1915. The average gross annual receipts for the 3-year period from 4.7 acres were \$275.48 per acre. Among the crops grown three years were celery with an average annual receipt of \$333.22; eggplant, yielding \$462.73; and tomatoes, early and late, yielding \$405.66 per acre. Cauliflower, which was grown but two years, gave an annual gross receipt of \$433.24 per acre.

A master farmer of seventy who grows truck crops and fruit in southern Jersey, H. R. COX (*Country Gent., 81 (1916), No. 26, pp. 1251, 1252, figs. 5*).—In addition to a brief account of operations on a successful fruit and truck farm a table is given containing an analysis of the business of the farm for the fiscal year ended March 1, 1916. One hundred and thirty-three acres of crops grown in that year yielded a labor income of \$3,583.

Onions.—Experiments and culture, T. H. WHITE (*Maryland Sta. Bul. 195 (1916), pp. 63-78, figs. 3*).—This bulletin gives the results of a number of miscellaneous experiments with onions conducted over a period of several years, together with directions for onion culture in Maryland.

In variety tests Gigantic Gibraltar grew the largest and made the best yield. Prizetaker, White Victoria, and White Globe all yielded well. Horbed grown plants on the average produced more bushels per acre than either sets or seeds sown outside. Poultry manure at the rate of 5,000 lbs. per acre, supplemented with 98 lbs. of sulphate of potash per acre, gave an increased yield of 36 bu. of onions over the check. A fertilizer containing 2 per cent potash obtained from muriate produced a better yield than a fertilizer containing either 4 or 8 per cent potash. Rows of onions planted 30 in. apart for horse cultivation yielded only 85.7 bu. per acre as compared with 130.6 bu. for rows 14 in. apart and cultivated by hand.

Composition of tomatoes from blighted vines, W. D. BIGELOW (*Canner, 43 (1916), No. 1, p. 30*).—The author finds that analyses of half-grown fruit which has ripened on a blighted vine are practically identical with those of half-grown tomatoes plucked from a healthy vine. Although not any more injurious to health than a green tomato, prematurely ripened tomatoes are considered to be undesirable for use as canning stock on account of the inferiority of the product made from them.

Bordeaux mixture stains removed, M. G. KAINS (*Country Gent.*, 81 (1916), No. 23, p. 1161).—Experiments reported by the author indicate that tomatoes and other vegetables stained with Bordeaux mixture may be freed from stain by dipping the vegetables in a solution of acetic acid. In the work here noted, which was conducted with tomatoes, a solution of half a cupful of pure acetic acid to 2 gal. of water was used. The dipped tomatoes were readily cleansed of the newly-formed acetates by passing the fruit under running water.

Report of general fruit committee, J. P. STEWART (*Proc. State Hort. Assoc. Penn.*, 57 (1916), pp. 15–20).—In this paper the author briefly reviews some of the more important work of the department of experimental pomology of the Pennsylvania Experiment Station.

The time of blossoming of fruit trees (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta.*, 1914, pp. 107–116).—Records for 1914 are given of the flowering dates of individual varieties of fruit trees grown in the plantations and orchards of the National Fruit and Cider Institute, Bristol.

The history of the classification of apples, E. A. BUNYARD (*Jour. Roy. Hort. Soc.*, 41 (1916), No. 3, pp. 445–464, pls. 4).—In this paper the author discusses the many attempts that have been made in the past to devise a system of classification for apples. The subject matter is presented for the special purpose of showing wherein such classifications have proved unsatisfactory.

Cultural methods in bearing orchards, J. P. STEWART (*Pennsylvania Sta. Bul.* 141 (1916), pp. 3–28, figs. 5).—In a previous bulletin of the station the results of some of the author's cultural experiments in young apple orchards were reviewed (*E. S. R.*, 33, p. 238). The present bulletin gives the results through the season of 1915 of six experiments started in bearing orchards in 1907–8. The experiments involved a comparative test of mulch, sod, tillage, and cover crop treatments, both with and without fertilizers.

Summing up the results thus far obtained it is found that the mulch treatment reinforced by outside materials has been most efficient in improving the yield, growth, and average size of the fruit in orchards up to about 20 years of age. It has also been most efficient in conserving moisture in all cases that have been determined. For orchards over 20 years of age tillage and cover crops slightly surpassed the mulch treatment, unless it was accompanied by adequate fertilization.

The sod treatment has usually given the lowest results in yield, growth, and average size of fruit in orchards of all ages, except when aided by special conditions. On the other hand, it has excelled in color of fruit and in freedom from blight. Fertilized sod plats have generally given better results than unfertilized plats receiving a mulch or tillage. Both the sod and the mulch treatments require thorough protection against mice.

Tillage has generally done best in the fully matured orchards, where it is especially efficient in stimulating growth. Tillage has done well in the younger orchards when accompanied by proper fertilization. The experiments with tillage as a whole indicate that plowing deeper than 4 in. is probably undesirable and that most of the cultivation should be done with disk harrows, or similar shallow-working cultivators rather than the plow. Cover crops have not proved especially beneficial unless the moisture supply was unusually good or the amount of food added was extra large.

In most of the experiments there has been a very close correlation between growth and bearing, except in the older orchards, when it is often possible to secure more growth than is necessary to maintain the best yields. Two of the experiments indicate that annual crops may be maintained by such biennial bearers as Baldwin and Spy in the presence of ample food and moisture supply, by regulation of the yield in any year to prevent overbearing and by preventing

injury to the root systems. In some cases there has been a very marked correlation between the amount of fire blight and the rate of growth. The greatest damage has occurred uniformly on the trees making the most growth. In view of the fact that weakly growing trees have also been attacked, it appears that it is the intermediate growth that is most resistant to this disease.

With regard to color in apples the author concludes that the red colors in apples are developed primarily by sunlight in the later stages of maturity. Hence conditions favoring either of these factors, such as late picking, open pruning, long growing season, sparse foliage, fully developed fruit, light soils, or sod culture, will increase this color, while all opposing conditions will decrease it. By a proper utilization of one or more of these conditions it is believed that the customary harmful effects on color of heavy tillage or too much nitrogenous fertilizer may generally be overcome.

The size of the fruit is determined chiefly by the moisture supply, hence the cultural methods that conserve moisture most efficiently will normally produce the largest fruit. Other influences of importance are the number of fruits on the tree, supply of plant food, and the temperature and length of the growing season.

Starch in apple trees, W. A. PRICE (*Ohio Jour. Sci.*, 16 (1916), No. 8, pp. 356-359).—An experimental study of the storage and migration of starch in apple trees is reported.

The author finds in substance that "during the dormant period starch reserve is stored in the living cells of the pith, wood parenchyma, and medullary rays of the apple. With approach of spring, starch is found in the tissues of the bark, appearing first in the phelloderm and collenchyma. As the leaves begin to appear starch begins to disappear from the various tissues in order as follows: Bark, wood parenchyma, rays, pith. It is used first from the youngest wood of the branches in the top of the tree, later from the lower portions of the tree, and finally from the roots. A portion of the starch reserve may never be used in the growth of the tree, but remains behind to be included in the heartwood, where it remains indefinitely and renders the wood susceptible to decay."

Stock influence upon vintage quality and other characters of apples, B. T. P. BARKER (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta.*, 1914, pp. 117-127).—The results are given of analyses made in 1914 of fruit juices from apples growing on different stocks. The data secured confirm the conclusion previously arrived at as to the negligible effect of the intermediate stock on vintage quality (*E. S. R.*, 33, p. 240).

Crown gall and resistant stocks, C. O. SMITH (*Cal. Citrogr.*, 1 (1916), No. 9, p. 14, fig. 1).—Studies are being conducted at the California Citrus Experiment Station with the view of securing resistant stocks for stone fruits.

Tabular results are here given showing the representative resistant and susceptible species and varieties in the various classes of stone fruits which were subjected to the crown gall by actually inoculating the rapid-growing twigs and branches with pure cultures. Among the almonds inoculated no marked resistance has been found. Stocks of the Domestic and Damson types of plums and certain Asiatic types of apricots showed the strongest resistance. The Golden Beauty variety of *Prunus hortulana* has shown sufficient resistance to be used as a stock for native plums. Among other American species, *P. pumila*, a dwarf stock used to some extent in the Middle West, was also strongly resistant.

The Japanese mountain cherries, wild forms and cultivated races, M. MIYOSHI (*Jour. Col. Sci. Imp. Univ. Tokyo*, 34 (1916), Art. 1, pp. 175, pls. 23).—A systematic study of the wild and cultivated forms of Japanese mountain cherries, including descriptions of species and varieties. The descriptive text

is accompanied by a number of illustrations in color of the floral parts and foliage of various forms of cherries, as well as illustrations showing the tree growth.

Peach package tests, season of 1915. J. M. CREELMAN (*Agr. Gaz. Canada*, 3 (1916), No. 3, pp. 222-225, figs. 3).—Data are given on shipping tests of various types of peach packages conducted under the direction of the Canadian Department of Agriculture in 1915.

The new vine; the hybrid producers. E. PÉF-LARY (*La Vigne Nouvelle; Les Hybrides Producteurs*. Paris: J. B. Baillière & Sons, 1915, pp. 72).—An account of the direct bearing hybrid grapes resulting from crosses between American and French species. The introductory chapter describes the principal characters of hybrid producers. The succeeding chapters deal with the cultural value of different color hybrids as well as their resistance to diseases, and the nature of the wines made from them.

The chemical composition of the Chasselas Doré and the advantages of bagging in keeping the grapes fresh. F. CHARMEUX (*Jour. Soc. Nat. Hort. France*, 4. ser., 17 (1916), May, pp. 72-74; June, pp. 90-93).—In some experiments in bagging grapes here reported it was found that the use of close paper bags not only prolongs the fresh appearance of the bunches but also gives the berries a more uniform quality and development and somewhat increases the sugar content of the grapes.

Official report of the session of the International Congress of Viticulture, San Francisco, Cal., July 12, 13, 1915 (*Off. Rpt. Sess. Internat. Cong. Vit.*, 1915, pp. 324, figs. 54).—These proceedings include the following papers, with discussions, delivered at the Congress: The Work of the State Viticultural Commission, by E. M. Sheehan (pp. 19-22); Probable Effect of the Federal Tax on Brandy upon the Horticultural Interests of California, by R. D. Stephens (pp. 23, 24); A Campaign of Wine Education, by H. F. Stoll (pp. 24-29); Early California Wine Industry, by H. Lachman (pp. 29-32); Love of the Vine, by L. J. Vance (pp. 32-35); Grape Breeding, by R. D. Anthony (pp. 35-39); Introduction of Viticulture into the Schools, by A. W. Miller (pp. 39-43); Resistant Vines, by G. C. Husmann (pp. 45-50); Pruning and Training American Grapes, by F. E. Gladwin (pp. 50-62); Commercial Fertilizers for American Grapes, by F. E. Gladwin (pp. 62-68); Phylloxera-Resistant Stocks in California, by F. C. H. Flossfeder (pp. 69-76); *Vitis vinifera* in Eastern America, by U. P. Hedrick (pp. 77-81); Viticulture on the Pacific Coast, by F. T. Bioletti (pp. 81-88); The Vineyards of the Columbia River Basin, by E. H. Twilight (pp. 89-91); The Grape in Oregon, by C. I. Lewis (pp. 91-97); Grape Growing in New Mexico, by F. Garcia (pp. 97-102); Grape Growing in Utah, by A. B. Ballantyne (pp. 102-106); Grape Growing in Imperial Valley, by W. E. Packard (pp. 107-110); Grape Anthracnose in America, by C. L. Shear (pp. 111-117); Powdery Mildew of Grapes and Its Control in the United States, by D. Reddick and F. E. Gladwin (pp. 117-125); Studies on *Plasmopara viticola* (Downy Mildew of Grapes), by C. T. Gregory (pp. 126-150); Methods of Preparation and Relative Value of Bordeaux Mixtures, by O. Butler (pp. 151-160); Sulphur Fungicides, by G. P. Gray (pp. 160-174); Grape Insects in California, by H. J. Quayle (pp. 174-181); Phylloxera in California, by R. L. Nougaret (pp. 181-186); The Grape Root Worm (pp. 187-195), The Grape Leafhopper (pp. 195-201), the Grapevine Fleabeetle (*Mallica chalybea*) (pp. 201-206), and The Rose Chafer (*Macrodactylus subspinosus*) (pp. 210-216), by F. Z. Hartzell; the Grape Berry Moth (*Polychrosis viteana*), by W. H. Goodwin (pp. 217-236); Two Destructive Grape Insects of the Appalachian Region, by F. E. Brooks (pp. 237-248); The Engineer's Part in the Advancement of the Viticultural Industry, by E. T. Meakin (pp. 248-253); Some Results of the Practical

Application of Sulphurous Acid and Selected Yeast in the Fermentation of California Wines, 1913 and 1914, by W. V. CRUESS (pp. 254-263); A Simple and Rapid Method for the Estimation of Volatile Acid in Wine, by W. V. CRUESS and R. W. BETTOLI (pp. 263-267); Influence of Composition on Effervescence of Champagne, Preliminary Investigations, by R. W. BETTOLI and J. LA BELLE (pp. 267-275); The Sugar and Acid Content of American Native Grapes (pp. 276-279), and The Composition of Pure Wine from American Native Grapes (pp. 280-287), by W. B. ALWOOD; Important Factors Governing the Successful Transportation of Table Grapes, by A. V. STUBENRAUCH (pp. 288-300); The Intelligent Blending of Wines, by H. S. DEWEY (pp. 301, 302); A New Utilization of a By-Product of the Grape, by G. ROSSATI (pp. 303-307); and Relation of the Maturity of the Grapes to the Quantity and Quality of the Raisins, by F. T. BIOLETTI (pp. 307-315).

The wild blueberry tamed, F. V. COVILLE (*Nat. Geogr. Mag.*, 29 (1916), No. 6, pp. 535-546, figs. 10).—In this article the author briefly reviews the progress that has been made in his cultural and breeding experiments with blueberries (E. S. R., 34, p. 534), and also in the culture of improved forms on the New Jersey trial plantation. On this plantation hybrid seedlings have borne their first commercial crop when only three years old and a crop three times as large when four years old.

Official proceedings of the twelfth annual convention, Michigan State Association of Ginseng Growers, 1916 (*Off. Proc. Ann. Conv. Mich. State Assoc. Ginseng Growers*, 12 (1916), pp. 45).—Various topics dealing with the culture and subsequent preparation of ginseng and goldenseal as discussed at the convention are included in these proceedings.

A preliminary study of Philippine bananas, N. G. TEONORO (*Philippine Jour. Sci., Sect. C*, 10 (1915), No. 6, pp. 379-421, pls. 12).—A descriptive account of the species and varieties of bananas known to occur in the Philippines, in which special attention has been given to the special purposes to which the different varieties are adapted.

{Cacao in British Guiana}, J. B. HARRISON (*Rpt. Dept. Sci. and Agr. Brit. Guiana*, 1914-15, pp. 26-30).—The results of manual and other cultural experiments with cacao in British Guiana are reported.

The experiments, which were commenced in 1900, indicate that in British Guiana under conditions similar to those existing at Onderstepoort farm the methods of cultivation leading to the successful growth of cacao are the reduction of shade to the lowest amount compatible with due protection from wind; deep and efficient soil drainage; annually forking the land between the trees without injuring the roots any more than is absolutely necessary; mulching the soil; and manuring the trees with a mixture of superphosphate of lime and sulphate of potash.

Eliminating the drone tree, L. B. SCOTT (*Cal. Citrogr.*, 1 (1916), No. 9, pp. 8, 9, 19, figs. 2).—A popular review of the results secured in California in the improvement of oranges and lemons by bud selection (E. S. R., 33, p. 737; 34, p. 639), including a description of methods employed in making records of the production of individual trees.

The rose annual for 1916 of the National Rose Society, edited by H. R. DABLINGTON (*London: National Rose Society*, 1916, pp. VIII+164, pls. 35).—This comprises a collection of articles on various phases of rose culture, including some general accounts of rose growing in different parts of the British Empire and elsewhere.

A partial list of plants available for various uses in general landscape planting, A. D. TAYLOR (*Cleveland, Ohio: Author*, 1916, pp. 51).—The plant materials listed in this booklet have been included with special reference to

their use in the Northern and North Central States. Concise information is given relative to the correct use of the more prominent species of trees, shrubs, vines, and perennials in ornamental and landscape plantings.

Ornamental gardening in Florida, C. T. SIMPSON (*Little River, Fla.: Author, 1916, pp. XIII+198, pls. 40, figs. 3*).—A treatise on the decorative plants adapted to Florida and their cultivation, with suggestions for the ornamentation of Florida homes and grounds.

FORESTRY.

Report of the Maryland State Board of Forestry for 1914 and 1915 (*Rpt. Md. State Bd. Forestry, 1914-15, pp. 77, pls. 7*).—A report on forest activities for the years 1914 and 1915 in which consideration is given to forest fire protection, assistance to owners of woodland, work on the state forest reserves and the state forest nursery, forest and tree planting operations under state supervision, investigational and educational work, and public shade tree work.

The Sequoia and General Grant National Parks, season of 1916 (*U. S. Dept. Int., Off. Sec. [Pub.], 1916, pp. 48, figs. 3*).—A pamphlet of information relative to the forests in these parks, methods of transportation, camp sites, birds, mammals, and fishes occurring there, rules and regulations, and literature dealing with the parks. See also a note by Hill (*E. S. R.*, 35, p. 242).

The Mesa Verde National Park, season of 1916 (*U. S. Dept. Int., Off. Sec. [Pub.], 1916, pp. 48, figs. 5*).—An account similar to the above relative to the Mesa Verde National Park.

Manual of instructions for county forest wardens and district forest wardens and information in regard to the prevention and suppression of forest fires, J. E. BARTON (*Frankfort, Ky.: State, 1915, pp. 31*).—Although designed primarily for forest officers this manual contains considerable information of value to the general public in the matter of controlling forest fires.

Forest protection.—I, Protection against animals, R. HESS (*Der Forstschutz. Erster Band: Schutz gegen Tiere. Leipzig: B. G. Teubner, 1914, vol. 1, 4. ed., rev., pp. XIII+537, pls. 2, figs. 250*).—A text-book, manual, and reference work on forest protection. The present edition has been entirely rewritten by R. Beck. The successive parts of the present volume deal in detail with protection against domestic animals, game, and other wild animals, birds, and insects.

Causes determining the forms of trees, P. JACCARD (*Rev. Gén. Bot., 27 (1915), Nos. 321, pp. 257-270, fig. 1; 323, pp. 335-349; 324, pp. 353-374, figs. 2*).—Recent experimental and mathematical investigations are said to have substantially confirmed the conclusion formerly reached (*E. S. R.*, 29, p. 312), and to have shown that the forms of tree trunks, those of *Picea excelsa* in particular, are directly influenced in essential characters, notably in the variations in thickness of the layers of growth, by the exigencies of circulation of water and of nutritive materials. See also a previous note (*E. S. R.*, 34, p. 536). The applicability of the theory of the slow selection of useful variations in this connection is denied.

On the amount of sap discharged by some trees, M. MIYOSHI (*Jour. Col. Sci. Imp. Univ. Tokyo, 38 (1916), Art. 1, pp. 14, figs. 4*).—Investigations conducted by the author with two species of trees showing high sap pressure, *Cornus controversa* and *Carpinus yedoensis*, led to the conclusion that it is impossible to secure accurate results relative to the discharge of sap for a longer time than one bleeding period where the usual method of collecting the sap from an auger hole is followed. A local stoppage in the hole is found to take place inevitably, thus influencing the amount of sap flow.

Pinus longifolia. a silvicultural study, R. S. TROUE (*Indian Forest Mem., Silviculture Ser., 1* (1916), No. 1, pp. 126, pls. 33).—The study here reported is based on personal investigations extending over a number of years in most of the important tracts in which *P. longifolia* forests occur.

The subject matter is presented under the general headings of the distribution, locality, and types of forest; silvicultural characters and requirements; natural regeneration; artificial regeneration; external dangers; fire effects and protection from fire; tending operations; systems of management; and statistical information.

Report on the question of field experiments, with special reference to the execution of tapping experiments on estates, G. E. COOMBS (*Agr. Bul. Fed. Malay States, 4* (1916), No. 8, pp. 229-242, figs. 4).—The purpose of this report is to present to rubber planters a statement of the general principles which should govern field experiments in tapping rubber.

Chief factors influencing the development of sal seedlings, R. S. HOLE (*Indian Forester, 42* (1916), No. 7, pp. 335-348, pls. 6).—A summary of some of the chief results of the study recently conducted at Dehra Dun, relative to the factors influencing the development of sal (*Shorea robusta*) seedlings.

Newfoundland and its forest resources, D. MORRIS (*Jour. Roy. Soc. Arts, 64* (1916), No. 3310, pp. 439-452; *Scot. Geogr. Mag., 32* (1916), No. 8, pp. 353-366).—An account is given of the forest areas, principal timber trees, and forest industries in Newfoundland.

Structural timber handbook on Pacific coast woods, O. P. M. GOSS and C. HEINMILLER (Seattle, Wash.: *The West Coast Lumbermen's Assoc., 1916*, pp. 289, figs. 38).—A handbook of information relative to the character, strength, durability, and uses of Pacific coast woods. The strength and durability data are based upon tests conducted by the Forest Service of the U. S. Department of Agriculture and other organizations.

The organization of the lumber industry, W. COMPTON (Chicago: *American Lumberman, 1916*, pp. X+153, figs. 23).—This comprises an analysis of the influences which have largely determined the recent course and the present level of the prices of lumber in the United States.

DISEASES OF PLANTS.

Plant diseases in England and Wales, 1914-15 (*Jour. Bd. Agr. [London], 22* (1916), No. 10, pp. 931-939).—This is a statement regarding plant diseases, insect pests, etc., issued in lieu of the annual report, temporarily suspended, of the horticultural branch of the Board of Agriculture.

It is stated that the mild weather in the spring of 1914 induced the summer stages of the American gooseberry mildew at an earlier date than any previously recorded in England and led to an unusually severe attack on the fruit. In 1915, the disease appeared somewhat later and was severe only where long drought had weakened the resistance of the bushes. Timely and proper pruning is supposed to afford complete protection and to benefit the bushes otherwise. This treatment should be carried out in the period between the "soft and the hard condition of the fruit." Fungicides check the disease under favorable conditions, but in no case was it completely killed out by their use. American gooseberry mildew is said to be known in all European countries.

Wart disease is reported to cause loss in over 200 industrial districts. Some potato varieties have now been tested many times and are considered to be completely immune. The number of cases in agricultural districts is very small, but the occurrence of sporadic cases suggests that the disease may be dormant

for a season under certain conditions. Tests with formalin promise little success.

Corky scab is said to be very much localized in England and rare in localities where potatoes are grown in large quantities. In a few cases it has been found in a high degree of intensity, proving as destructive as wart disease. No remedy is known for corky scab, to which every variety of potato appears to be susceptible, but it spreads slowly and does not appear to persist in well cultivated soil.

Silver leaf of plums and apples and apple mildew have been studied to some extent. *Dilophia graminis* has been discovered on wheat in two localities.

Recent observations on diseases of cultivated plants in Bohemia, A. KŮTÍN (Věstník 5. Sjez. Čes. Pěst., 1915, p. 427; abs. in Bot. Centbl., 129 (1915), No. 15, p. 384).—Observations are recorded on the appearance in Bohemia for the first time of *Tilletia laevis*, *Peronospora jaapiana*, and *Typhula graminum*, and the reappearance, after some years, of *Tilletia secalis*. *Sclerotinia trifoliorum* has been noted in new localities, and *Spharotheca mors-uvæ* appears to have attained wide if not universal distribution.

Cryptogamic parasites of cultivated plants in and near the Province of Turin in 1913, P. VOGLINO (Ann. R. Accad. Agr. Torino, 57 (1914), pp. 159-174; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 3 (1915), No. 6, pp. 881, 882).—This is an arrangement of the data as collected in 1913 regarding weather and regarding cryptogamic parasites of plants in this region. The diseases noted, while encouraged in some degree by the spring rains, were later held in check by the dryness of the summer season.

Recent contributions to our knowledge of the genus *Gymnosporangium*, F. D. KECK (Abs. in Science, n. ser., 43 (1916), No. 1106, p. 364).—The author reviews information regarding the genus *Gymnosporangium*, supplemental to his previous report (E. S. R., 27, p. 424). Among the more notable points brought out are the reporting of another aecial host outside of the Rosales, the finding of teliospores in the species possessing uredinia, studies of the effects produced by the host on the morphology of the fungi, and active investigations of the species causing diseases of economic importance.

Cultures of Uredineæ in 1915, J. C. ARTHUR (Mycologia, 8 (1916), No. 3, pp. 125-141; abs. in Science, n. ser., 43 (1916), No. 1106, p. 363).—With this report, the fourteenth of a series continued by the author since 1899 (E. S. R., 22, p. 750) on the culture of plant rusts, it is proposed to end the series of investigations.

Besides notes on species giving negative results owing to inadaptation of the racial material used, an account is given of successful cultures supplementing work previously reported in case of 8 species named and a list of 4 species now reported for the first time.

White speck disease of leaves, C. VON TUBEUF (Naturw. Ztschr. Forst. u. Landw., 13 (1915), No. 10, pp. 469-475, figs. 3).—The author describes a peculiar leaf decoloration, which is said to be associated with the absence of chlorophyll, starch, and generally plasma in the palisade cells. The affected areas are small but thick. A list is given of woody plants and one of herbaceous plants known to exhibit this phenomenon.

Further evidence that crown gall of plants is cancer, E. F. SMITH (Science, n. ser., 43 (1916), No. 1121, pp. 871-889).—This is a paper read before the Washington Academy of Sciences, in which the author presents further evidence that crown gall of plants is cancer, and that cancer in plants, because of its variable form and its bacterial origin, offers strong presumptive evidence both of the parasitic origin and of the essential unity of the various forms of cancer occurring in man and animals.

Concerning certain peculiar tissue strands in a *Protomyces* gall on *Ambrosia trifida*, A. STEWART (*Abs. in Sci. c. n. ser.*, 43 (1916), No. 1106, pp. 365, 366).—The stems of the great ragweed are said to be sometimes infected by *P. andinus*, causing the formation of large galls. These usually occur just above the ground, but often higher on the stem, sometimes as much as 2 ft. above the galls which are located near the roots. Both kinds of galls have essentially the same histological structure, the deeper portions near the pith having peculiar tissue strands which are similar in some respects to the tumor strands found in certain plants affected with the crown-gall organism. The fact that the abnormalities in the tissues of the host plants are found in or near to the pith indicates that the stems become infected when quite young. This is offered as a possible explanation as to how the upper galls of the stems are produced.

Acid sprays as related to scorching, L. DEGRULLY (*Prog. Agr. et Vit. (Ed. Est-Centre)*, 37 (1916), No. 16, pp. 365-367).—It is stated that while low concentrations, for example 1 per cent copper sulphate and 0.1 per cent carbonate of soda in Burgundy mixture, are rarely dangerous, the same proportions maintained in higher concentrations may prove very injurious to foliage. With 2 per cent sulphate and 0.9 per cent carbonate, the foliage seldom, if ever, scorches, with 2 per cent sulphate and 0.875 carbonate rarely, while with 2 per cent sulphate and 0.75 carbonate the preparation is very strongly acid, and is not ordinarily to be recommended for use after the blooming period. Bordeaux mixture containing 1 per cent copper sulphate and 0.5 per cent lime (sometimes contaminated by the presence of magnesium) practically always gives an alkaline solution.

The powdery mildews of Avena and Triticum, G. M. REED (*Missouri Sta. Research Bul.* 23 (1916), pp. 5-19).—In previous publications (E. S. R., 21, p. 641), the author showed that the morphological species, *Erysiphe graminis*, consists of a large number of different races. In a subsequent paper (E. S. R., 27, p. 545), the results of infection experiments with the powdery mildew of wheat were given. The present paper gives the results of a large number of additional experiments with *E. graminis* on Avena and Triticum. Seed of these genera was obtained from various sources, 165 varieties of wheat being tested with reference to their susceptibility to the fungus. A great majority of these varieties proved quite susceptible. All of the eight recognized types or species of Triticum contained susceptible varieties, and only a few distinctively resistant varieties were found.

An account is also given of the physiological race of *E. graminis* which occurs on species of Avena. Tests have been made of 41 varieties belonging to 17 species, and a great majority have proved susceptible to the oat mildew. It was also found that the wheat mildew readily passed over to certain species of *Eglops* and the oat mildew to *Arrhenatherum avenaceum*.

A Phytophthora on oats, J. McMURPHY (*Science, n. ser.*, 43 (1916), No. 1111, p. 534).—The author reports observing on leaves of oats in California a species of *Phytophthora* which is said to be similar to *P. col-casia*. A more extended study, however, is considered necessary to determine the specific rank of the fungus. The markings produced on the oats by the fungus may appear as spots or stripes along one or both margins of the leaf, or as a stripe down the center. The diseased areas become yellowish and then whitish when conidia are abundant. Later these areas, which sometimes have a water-soaked appearance, may become brown or reddish-brown, and the parts shrivel and dry up.

Seed treatment tests, 1914, L. HILTNER (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser.*, 13 (1915), No. 6-7, pp. 65-90).—This deals in considerable detail with experiments carried out in Bavaria during 1914 by steeping seed grain of

winter rye and wheat in solutions containing corrosive sublimate as a protection against *Fusarium* and other fungi. The variety, degree of attack, germinability, grain weight, and fall and spring conditions are noted in the tables given.

The relation of the seed stock to the control of bean anthracnose and bean blight, J. H. MUNCIE (*Abs. in Science, n. ser.*, 43 (1916), No. 1106, p. 365).—On account of the failure of fungicides in the control of these diseases and pending the experiments on the growing of seed for Michigan planting in western States, where anthracnose is unimportant, the author recommends the planting of varieties of beans of high productivity, so that the losses in ordinary years will be so decreased as not to be burdensome to the industry. Such a variety, it is said, has been found in the Early Wonder, which matures early and is very productive even under severe disease and weather conditions.

Angular leaf spot of cotton, F. M. ROTHS (*South Carolina Sta. Bul.* 184 (1915), pp. 3-30, pls. 8).—An account is given of an investigation of the angular leaf spot of cotton, the first description of which appears to have been given by Atkinson (*E. S. R.*, 3, p. 7). According to the author's investigations, this disease is believed to be common in every cotton-growing State in the Union.

The disease produces angular spots on the leaves, and blackened areas are formed on the stalks and branches. It also attacks young bolls. Young seedling plants usually suffer most severely and in many cases are killed outright. The cause of the disease is said to be *Bacterium malvacearum*, which survives the winter in and on the seed and also on the lint. Delinting the seed with sulphuric acid or treating the seed with hot water at 72° C. for 18 minutes greatly reduced the number of infected plants. Delinting the seed and spraying the plants six times with Bordeaux mixture resulted in the production of 98 per cent of sound plants. This method of treatment would probably be practicable where plants are grown for seed production.

Anthrachnose (*Colletotrichum lagenarium*) a serious disease of cucurbits, J. J. TAUBENHAUS (*Abs. in Science, n. ser.*, 43 (1916), No. 1106, p. 366).—A preliminary report is given of investigations of anthracnose of watermelons, cantaloups, cucumbers, and other cucurbits. These are said to be seriously affected in Delaware, and similar conditions are reported in New Jersey, Maryland, and Virginia. The disease attacks the fruit, particularly in case of the watermelon, and also causes a serious leaf spot and a blight and canker of the vines. The attacks are severest on the watermelon crop in its second successive year. On this account, growers are forced to practice rotations of six years or longer.

Inoculations have shown that the anthracnose from the watermelon, cantaloup, cucumber, citron, and ornamental gourd is identical, the disease being readily transferred from one host to another. Investigations are said to be in progress to determine the life history of *C. lagenarium*, its relationship to the various hosts, and to other species of *Colletotrichum*, especially *C. lindemuthianum*.

Potato diseases and their control, E. C. STAKMAN and A. G. TOLAAS (*Minnesota Sta. Bul.* 158 (1916), pp. 3-47, figs. 28).—Descriptions are given of a considerable number of parasitic and nonparasitic diseases of potato, with suggestions for their control. For the leaf diseases, Bordeaux mixture is recommended, while wilt diseases and stem rot may be controlled by roguing fields, by selecting and disinfecting seed, and by rotating crops. Experiments conducted during 1914 and 1915 showed that the average yield of potatoes per acre was increased 56 bu. in 16 fields by seed selection and disinfection. Spraying experiments which have been carried on for seven years gave an average annual increase of 63 bu. per acre of early potatoes sprayed 3 times with Bordeaux mixture or of late potatoes sprayed 4 times.

Potato disease, KORFF (*Prakt. Bl. Pflanzenbau u. Schutz*, n. ser., 13 (1915), No. 8, pp. 109-111, figs. 2).—Brief reference is made to a leaflet issued by the Institute for Agricultural Botany at Munich, dealing with leaf disease and Phytophthora tuber rot of potato and the control of both these troubles by the timely use of copper sprays.

Marasmius on sugar cane, J. R. JOHNSTON (*Mycologia*, 8 (1916), No. 2, p. 115).—Referring to the description given by Fulton (E. S. R., 19, p. 956) of the fungus designated by him as *M. plicatus*, causing root disease of sugar cane in Louisiana, the author states that his own specimens on sugar cane from Louisiana and Texas answer rather to the description of *M. stenophyllus* (*M. semiustus*), said to have been reported on bananas in many West Indian islands but not before on sugar cane.

Effect of colored light on the mosaic disease of tobacco, G. H. CHAPMAN (*Science*, n. ser., 43 (1916), No. 1111, pp. 537, 538).—The author reports some investigations conducted to verify the conclusions of Lodewijks (E. S. R., 24, p. 648) that blue light offers a cure for the mosaic disease of plants.

The diseased leaves of a number of tobacco plants were covered with hoods composed of different colored cloth, and it was found that when blue light was used there was a suppression of the leaf color variation more or less permanent in character. With a single exception, the treated plants showed no typical symptoms of the disease for at least two weeks after the removal of the hoods. That the disease was, however, not controlled was shown by the inoculation of healthy plants with the juice of the treated plants, as this produced the disease in nearly every case. This is taken to show that the active principle of the disease is present in the apparently normal, fully recovered leaves and that it is highly infectious.

The leaf spot disease of tomato, E. LEVIN (*Michigan Sta. Tech. Bul.* 25 (1916), pp. 5-51, pls. 9, figs. 2).—This bulletin gives the results of experiments on the leaf spot disease of tomato, due to *Septoria lycopersick*, and recommendations for its control. While many investigators have reported this fungus as causing the leaf spot disease of tomato, its parasitism was definitely proved by the author's investigations. The morphological, ecological, and physiological relations of the organism are described at some length, and control measures, which include the planting of clean seedlings in clean soil and thorough spraying with Bordeaux mixture, are recommended.

A canker of apple caused by *Plenodomus fuscomaculans*, G. H. COONS (*Abstr. in Science*, n. ser., 43 (1916), No. 1106, p. 364).—A serious canker of apple is said to occur in some orchards in northern Michigan. The canker is characterized by elongated lesions which are commonly accompanied by a checking of the bark into small squares or rectangles. The lesions are said to extend along the limb, commonly on the underside. In the older cankers the killed bark drops off, leaving the bare wood.

The causal relation of the associated organism has been shown by inoculation experiments, and the results of a study of its physiological relations have been previously noted (E. S. R., 31, p. 647). Successful inoculations were obtained on the limbs of Wealthy, Duchess, Jonathan, and Ben Davis apples, as well as on the Hyslop crab. Other standard varieties seem more resistant. The fungus has also been successfully inoculated into pear, small cankers having been formed, but no inoculations have succeeded on apple leaves.

The disease, it is claimed, may be successfully controlled by the means commonly advised for apple canker.

Fungi producing the heart rot of the apple, B. O. DODGE (*Mycologia*, 8 (1916), No. 1, pp. 5-15, pls. 4; *abstr. in Science*, n. ser., 43 (1916), No. 1106, p. 366).—Living apple trees at Litchfield, Conn., are reported as being infected

with *Polyporus admirabilis* during August. Apple trees in the eastern United States are said to be more commonly attacked by another type of *Polyporus*, *P. galactinus* or *P. spumescens malicola* is the species ordinarily found in old orchards of the New England States, while *P. fissilis* is reported as attacking trees in Virginia.

Monilia on fruit trees, G. VOSS (*Flughl. Samml. Pflanzenschutz, K. Landw. Akad. Bonn-Poppelsdorf*, No. 7 (1915), pp. 4, figs. 5; *abs. in Bot. Centbl.*, 129 (1915), No. 22, pp. 574, 575).—A description is given of symptoms and results of attack on fruit trees by the Monilia forms of *Sclerotinia cinerea*, *S. fructigena*, and *S. laxa*. Protective measures include the early removal and destruction of all affected parts, including fallen fruits and dead wood.

Apricot fruit spots, J. T. BARRETT (*Univ. Cal. Jour. Agr.*, 3 (1916), No. 8, pp. 346-349, figs. 5).—Descriptions are given of brown rot of apricot, caused by *Puccinia pruni-spinosa*; of Coryneum fruit spot, due to *C. beijerinckii*; and of scab or black spot of apricot, caused by *Cladosporium carpophilum*. It is said to be easy to confuse some of these, especially in their early stages.

The reciprocal influence between mycotrophic roots of different plants, L. PETRI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat.*, 5, ser., 24 (1915), II, No. 11, pp. 536-539, fig. 1).—Describing the results of growing oaks and olives in close proximity, the author holds that the injury often observed to be suffered by the olive in this relation may be due to the impoverishment of the soil by the oak or to an eventual root rot caused by a *Dematophora* developing on the subterranean residues of the oak growths, and not to the proximity of the mycorrhiza on the oak. The possible bearing in this connection of facts previously observed (*E. S. R.*, 26, p. 849) is discussed.

Formalin as a spray against American gooseberry mildew (*Deut. Landw. Presse*, 42 (1915), No. 36, p. 329; *abs. in Internat. Inst. Agr. [Rome]*, Mo. Bul. Agr. Intcl. and Plant Diseases, 6 (1915), No. 7, p. 999).—B. Panten of Kazmierz, Posen, reports that a 1 per cent solution of 40 per cent formalin, thoroughly applied in the early spring and again before the period of blooming, effectively controlled American gooseberry mildew.

A new fungicide for use against American gooseberry mildew, J. V. EYRE and E. S. SALMON (*Jour. Bd. Agr. [London]*, 22 (1916), No. 11, pp. 1118-1125; *abs. in Gard. Chron.*, 3, ser., 59 (1916), No. 1523, p. 132).—It is stated that an ammonium sulphid solution containing 0.18 per cent of sulphur can be recommended for commercial use on an experimental scale for the purpose of protecting the fruit of gooseberries against the mildew. Lime-sulphur wash should be employed for early sprayings until such time as its use would affect the marketing of the berries, when the ammonium sulphid solution should be substituted. It is stated that solutions of liver of sulphur at the strength usually considered as fungicidal are inefficient against the disease, while concentrations which are fungicidal cause such severe scorching of the gooseberry bushes as to preclude their use in this connection.

Notes on the dying of citrus trees, A. H. BENSON (*Queensland Agr. Jour.*, n. ser., 5 (1916), No. 5, pp. 258-266).—Concerning the dying of citrus trees in different sections, a progress report made by F. Smith is quoted at some length with comments thereon. The trouble is considered due to causes other than soil conditions, and as more probably parasitic in character, though possibly very complex in origin. Age and living conditions of the trees are discussed in this connection. It is thought possible that irregularity in growth may prove to be very important.

Descriptions are given also of other twig, collar, and root troubles.

Fungi attacking cultivated and wild Orchidaceæ and their control, G. LINDAU (*Gartenflora*, 64 (1915), Nos. 21-22, 23-24; *Orchis*, 9 (1915), Nos. 7, pp. 171-178; 8, pp. 181-203).—Descriptive lists are given including many Uredineæ, Ascomycetes, and imperfect fungi attacking orchids in many widely separated regions of the world.

Black canker in young chestnut trees and nurseries, G. BRIOSI and R. FARNETH (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat.*, 5. ser., 24 (1915), I, No. 2, pp. 98-105; *abs. in Internat. Inst. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases*, 6 (1915), No. 4, pp. 637, 638).—It is stated that black canker may attack not only adult chestnut trees but also very young plants and even germinating seed, so that a considerable epidemic of this disease may occur in the nursery. The disease is said to be due to infection and not to soil exhaustion.

Studies on diseases of oak, E. MÜNCH (*Naturw. Ztschr. Forst u. Landw.*, 18 (1915), No. 11-12, pp. 509-522, figs. 6).—Previous reports (E. S. R., 24, p. 52) are followed up by an account of a study of *Polyporus igniarius*, the cause of white rot of oak, more particularly as regards its rate of progress in canker formation and the different rates of progress in cambium, bast, and sapwood.

Monograph on oak mildew, F. W. NEGER (*Naturw. Ztschr. Forst u. Landw.*, 18 (1915), No. 11-12, pp. 544-550, figs. 2).—The article previously noted (E. S. R., 33, p. 745) is here supplemented by an account of tests with the *Oidium* causing oak mildew on species of *Rubus*, from which the author concludes that under appropriate conditions a fungus may flourish and even produce spores on a host normally foreign thereto, and that on the basis of studies involving such cases errors of identity may be promulgated. The overwintering of oak mildew is also discussed.

A new disease of walnuts, H. MEMMLER (*Gartenwecht*, 19 (1915), No. 53, pp. 623, 624, fig. 1).—A nut spot of walnut is described as apparently new, but the cause of the trouble has not yet been determined.

Note on western red rot in *Pinus ponderosa*, W. H. LONG (*Mycologia*, 8 (1916), No. 3, pp. 178-180).—Reporting on the study of the heart rot of western yellow pine, called western red rot in order to distinguish it from a very similar heart rot called red heart or red rot (*Trametes pini*) common in many species of conifers, the author states that the western red rot has three developmental stages. The first shows reddish to dark brown areas in the heartwood which is still firm, the second a whitish or gray color with more or less delignification, and the third a disappearance of much of the heartwood and a very brittle condition of the particles which remain.

This fungus never forms the brown, woody, perennial fruiting bodies on living pine trees that *T. pini* does but forms annual fruiting bodies which usually develop as white encrusting layers on the underside of logs. The pileate form of the fungus resembles very closely *Polyporus ellisianus* (*Tyromyces ellisianus*) and is thought to be specifically identical therewith. The rot is very common throughout the western yellow pine regions of Arizona and New Mexico, and is known to occur in Vermont, New Jersey, Washington, Idaho, and South Dakota.

The fungus enters the living tree, passing through the sapwood, then the heartwood of dead branches, then down into the heartwood of the living tree. During the black jack stage, *i. e.* when not over the age of 150 years, the trees are practically free from this rot. It is, however, exceedingly common in the older trees on account of the dead branches, this factor favoring a short forest rotation. Thin soils on steep southern or eastern slopes, where growth conditions are poor, seem to encourage western red rot.

Laboratory tests on the durability of American woods.—I. Flask tests on conifers, C. J. HUMPHREY (*Mycologia*, 8 (1916), No. 2, pp. 80-92, pl. 1).—This work has been in progress for about three years. In most cases both heart and sap wood were used. The blocks cut from logs brought to the laboratory green were placed in flasks, and inoculated plentifully with bean-pod cultures of *Lentinus lepideus*, and kept 4, 8, or 12 months. The results are tabulated and some are discussed.

The order of resistance in case of the highest three, as measured by the smallness of loss in weight by the heartwood during 12 months, was California juniper (3.3 per cent), white cedar (5.4 per cent, sapwood 7.7 per cent); and white pine (8.8 per cent). The loss for both heart and sap wood of fir, spruce, hemlock, and most of the pine during this period ranged within or around 60 to 70 per cent.

Further tests on heartwood of some of the species are considered necessary before safe comparisons can be made.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A history of British mammals, G. E. H. BARRETT-HAMILTON and M. A. C. HIXON (*London: Gurney & Jackson, 1916, vol. 2, pt. 18, pp. 553-609, pls. 3, figs. 2*).—A continuation of the Muridae of the Rodentia, previously noted (E. S. R., 35, p. 252), in which the harvest mouse (*Micromys minutus*) and the black or ship rat (*Epimys rattus*) are considered.

Rats and rat riddance, E. H. FORBUSH (*Agr. of Mass., 62 (1914), pp. 169-251, pls. 12, figs. 19*).—This account deals somewhat at length with the biology of rats, their economic importance, and the various means by which they may be held in check.

Description of a new pine mouse from Florida, A. H. HOWELL (*Proc. Biol. Soc. Wash., 29 (1916), pp. 83, 84*).

Fumigation of animals to destroy their external parasites, W. MOORE (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 71-80, figs. 2*).—The author has met with success in the fumigation of animals with nitrobenzene, the insects being killed without injuring the host.

Report of the entomologist of the Arizona Commission of Agriculture and Horticulture for the year ended June 30, 1915, A. W. MORRILL (*Ariz. Com. Agr. and Hort. Ann. Rpt., 7 (1915), pp. 9-50, pls. 6, figs. 18*).—The first part of this report (pp. 9-26) relates to the inspection of plant, fruit, and seed importations; the provision for the terminal inspection of plant products shipped by parcel post; inspections of orchards, nurseries, and fruit products of the State; alfalfa weevil protection; and insect control and eradication. The second part (pp. 27-46) consists of notes on the important insects of the year under the headings of pests of deciduous fruits and vines, citrus and olive pests, pests of field and forage crops, vegetable crop pests, cotton pests, and a range plant pest (*Trirhabda canadensis*). Part 3 (pp. 47-50) describes two vegetable pests to be guarded against, namely, dodder, a menace to the alfalfa seed-growing industry, and citrus canker.

Among the more important insects mentioned are the steel-blue grapevine flea-beetle (*Haltica carinata*), which was an important pest in the Salt River Valley during the spring; the clover mite, which did some damage to almonds in an orchard near Mesa, Ariz.; the flat-headed apple-tree borer, which was unusually destructive to peach, apricot, and plum trees in the Salt River Valley; the wheat or flower thrips (*Frankliniella tritici*), which was particularly injurious to blackberries and found also in the blossoms of the olive in the spring of 1915; two walnut borers (*Prionus californicus* [?] and *Euzophera agylla*):

the common alfalfa grasshopper (*Melanoplus differentialis*), the three-cornered alfalfa hopper (*Stictocephala festina*), and the clover stem borer in alfalfa; the Mexican moth borer (*Diatraea lineolata* ?); billbugs injurious to sugar cane (*Sphenophorus phaniciensis*); the potato stalk borer which is becoming of increasing importance in southern Arizona; the two-spotted red spider (*Tetranychus bimaculatus*); the cotton leaf miner (*Bucculatrix thurberiana*); a capsid closely related to the tarnished plant bug; etc.

First biennial report State Crop Pest Commission of West Virginia, March 1, 1913, to June 30, 1914, W. E. RUMSEY ET AL. (*Crop Pest Com. W. Va. Bien. Rpt. 1 (1913-14)*, pp. 132, figs. 38).—This consists of the report of the state entomologist, and discussions of inspection work; nursery registration; cedar rust eradication in Berkeley County; distribution, abundance, injury, etc., of periodical cicada in 1914; control of apple and peach tree borers; chestnut blight eradication work, etc. Several bulletins issued by the commission, viz, (1) State Crop Pest Law, Rules and Regulations of the Commission; (2) Orchard Inspection, Apple Rust, Chestnut Bark Disease; (3) The San José Scale; and (4) The Periodical Cicada in West Virginia in 1914 and The Green Apple Aphid and Other Plant Lice are included. The text of a proposed crop pest law to supersede the present statutes is appended.

Insects in the Virgin Islands, H. A. BALLOU (*Agr. News [Barbados]*, 15 (1916), No. 361, pp. 74, 75).—A brief account based upon a collection of insects made by the curator of the experiment station in the Virgin Islands.

Insect pests of plants, Northern Territory of Australia, G. F. HILL (*Bul. North. Terr., Aust.*, No. 13 (1915), pp. 16).—A brief account is given of the more important insect pests of plants in Northern Territory, Australia, including a description of the life history, natural enemies, and methods of control of each.

Insects infesting the cotton plant in Trinidad, F. W. URICH (*Bul. Dept. Agr. Trinidad and Tobago*, 15 (1916), No. 1, pp. 18, 19).—This paper briefly considers eleven species of insects, their common names, natural enemies, economic status, and control measures.

Some insects of *Solanum carolinense* and their economic relations, M. P. SOMES (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 39-44).—The author reports observations of the sudden development of the berytid bug *Satysus spinosus* as a serious pest of the tomato. Previous to this time *S. carolinense* had served as its food plant. It is stated that during the past two years this insect has worked widely through Missouri and in some districts where tomato raising for canneries is of importance has occasioned serious loss.

Sesia rileyana occurs in large numbers on *S. carolinense*. Boring into the central part of the stem it works downward to the roots, and passing down one of the main branches at about the time it matures bores out of the root into the soil. A test transfer of larvæ from the horse nettle to tomato and potato succeeded.

A tortoise beetle (*Cassida pallidula*), a tingitid bug (*Gargaphia solani*), the potato stalk borer, the flea beetles *Epitrix fuscata* and *E. cucumeris*, the common sphingids *Phlegethontius carolina* and *P. quinquemaculata*, and a lygreid bug (*Ischnodemus falcatus*), which attack cultivated crops, are reported as occurring on *S. carolinense*.

Rhodesian citrus pests, R. W. JACK (*Rhodesia Agr. Jour.*, 13 (1916), Nos. 1, pp. 69-83, pls. 3; 2, pp. 215-233, pls. 6).—A brief summary of the insect enemies of citrus in Rhodesia and measures for their control.

Lepisma saccharina (?); its life history and anatomy and its gregarine parasites, J. W. CORNWALL (*Indian Jour. Med. Research*, 3 (1915), No. 1, pp. 116-131, pls. 6).—Accounts of the biology of the common silver fish of India and of two distinct gregarines parasitic in its gut.

A new Physothrips (Thysanoptera) from Uganda, with a note on Physothrips antennatus, J. D. HOOD (*Canad. Ent.*, 48 (1916), No. 4, pp. 130-132, fig. 1).

Heliethrips haemorrhoidalis injurious to ornamental plants in the Province of Buenos Aires, Argentina, C. LAZER (*Agronomia [Buenos Aires]*, 6 (1915), No. 56-58, pp. 9-11, figs. 3; *abs. in Internat. Inst. Agr. [Rome]*, Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 11, pp. 1549, 1550).—The author records injury to *Pelargonium peltatum* and *Lagerstræmia indica* by this thrips.

Eradication of the bedbug by superheating, W. A. ROSS (*Canad. Ent.*, 48 (1916), No. 3, pp. 74-76).—This paper records the extermination of *Cimex lectularius* from a 2-story, 8-room frame house, heated with a hot-air furnace and kitchen and parlor stoves, in which the temperature of three of the rooms was raised as high as 140, 158, and 162° F., respectively. Very satisfactory results were obtained, the pest being fully eradicated and the house furniture not damaged to the slightest degree. It is thought that the temperature obtained was unnecessarily high and that the superheating would have been equally effective if the temperature had been maintained between 120 and 130°.

Life history notes on *Apateticus cynicus* and *A. maculiventris*, R. D. WHITMARSH (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 51-53).—These notes relate to the biology, including the predatory habits, of two stink bugs. The former, the largest and most common predacious species, unlike the latter, is single brooded.

The distribution of the periodical cicada in Ohio, H. A. GOSSARD (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 53-59, figs. 3).—A report of the present distribution of the broods of 1906, 1914, and 1915 in Ohio.

Notes on the tomato psylla, H. COMPERE (*Mo. Bul. Com. Hort. Cal.*, 5 (1916), No. 5, pp. 189-191, figs. 3).—These notes relate to the biology and control of *Paratrioza cockerelli*, found by the author infesting the Jerusalem cherry (*Solanum capsicastrum*) at Sacramento and San Francisco. The solanums at the latter place were rendered worthless.

Concerning problems in aphid ecology, EDITH M. PATCH (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 44-51).—A discussion of some of the important ecological problems.

The present state of our knowledge of the biology of the vine phylloxera, B. GRASSI (*Internat. Inst. Agr. [Rome]*, Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 10, pp. 1269-1290).—This article reviews the status of knowledge of the biology of the grape phylloxera previous to 1905, and discusses the advances resulting from researches made since that date and the question as to the existence of different races of phylloxera.

Modern views of the control of the vine phylloxera, B. GRASSI (*Internat. Inst. Agr. [Rome]*, Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, pp. 1553-1571).—The author discusses the importance of control and methods usually employed, the method of control in Italy, the advisability of continuing the campaign, the manner of dispersal of the phylloxera, and the proposed method of control.

A nematode parasite of root aphids, J. J. DAVIS (*Psyche*, 23 (1916), No. 2, pp. 39, 40, fig. 1).—The author reports having found apterous viviparous and oviparous individuals of a new species of *Anaëcia* infested with nematodes at West Lafayette, Ind.

Two newly-established scale insects, E. O. ESSIG (*Mo. Bul. Com. Hort. Cal.*, 5 (1916), No. 5, pp. 192-197, figs. 6).—The camellia scale (*Pulvinaria floccifera*) and the dictyospermum scale (*Chrysomphalus dictyospermi*) are reported to have recently become established in limited districts in California.

On the structure and biology of *Tachardia lacca*, with observations on certain insects predacious or parasitic upon it, A. D. IMMS and N. C. CHATTERJEE (*Indian Forest Mem., Forest Zool. Ser.*, 3 (1915), No. 1, pp. 42, pls. 8).—Historical notes are first given, followed by a discussion of the systematic position of this coccid, the secretion and chemical composition of lac, its life history, distribution in India, and chief food products, together with descriptions of its several stages, habits, insect enemies, etc. A bibliography of 29 titles is included.

The rice stem borer in the Konkan, R. S. KASARGODE and V. G. DESHPANDE (*Dept. Agr. Bombay Bul.* 69 (1915), pp. 18, pl. 1).—This is a detailed account of *Schoenobius bipunctifer*, a lepidopteran which occurs throughout the greater part of the Indian rice area. It is the source of a large percentage of the insect injury to rice, which is rarely less than 10 per cent of the crop and may be as high as 80 per cent. The caterpillar attacks the plant at some point in the stem, which soon withers and turns white. Six days are required for its embryonic development, 27 for the larva, and 9 for the pupa, or a total of 42 days for the life cycle.

Climate and variations in the habits of the codling moth, E. P. FELT (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 107-110).—It is the author's opinion that, if conditions obtaining in New York during the past two or three years are reliable criteria, climatic differences exert a considerable influence upon the habits and the type of injury caused by the codling moth.

Notes on crambids, G. G. AINSIE (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 115-119).—Miscellaneous notes relating to the methods of rearing, etc., of crambids.

The control of the grape berry worm (*Polychrosis viteana*), W. H. GOODWIN (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 91-106).—Substantially noted from another source (E. S. R., 35, p. 358).

Preliminary studies of the biological control of the grapevine pyralid (*Enophthra pilleriana*), F. SCHWANGART (*Naturw. Ztschr. Forst u. Landw.*, 13 (1915), Nos. 8-9, pp. 389-408; 11-12, pp. 522-541).—The first part of this paper (pp. 389-398) deals with parasites of *E. pilleriana*, particularly the dipterans *Protopopos fugax*, *Nemorilla maculosa*, *Gymnopaera (Actia) pilipennis*, and *Cyrtoneura stabulans*. The second part (pp. 398-408, 522-534) consists of a discussion of the parasites of *Hyponomeuta* and their relation to the vine leaf rollers (*E. pilleriana*, *Clysis ambiguella*, and *Polychrosis botrana*), and the third part (pp. 534-541) comprises conclusions, etc.

The pilotaxy of *Anopheles*, S. R. CHRISTOPHERS (*Indian Jour. Med. Research*, 3 (1915), No. 2, pp. 362-370, pl. 1).—This article deals with the more important chæte of *Anopheles*.

The male genitalia of *Anopheles*, S. R. CHRISTOPHERS (*Indian Jour. Med. Research*, 3 (1915), No. 2, pp. 371-394, pls. 6).—An anatomical study which includes descriptions and drawings of the genitalia of most of the oriental species of *Anopheles* and of such others as were available. The author considers the genitalia to be the most satisfactory means for classifying the group.

Dasyneura ulmea, a new elm pest, J. S. HORSER (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 82-84, fig. 1).—The author reports that this itonidid is the source of injury to elms in Ohio. Its attack results in the formation of from 1 to 20 aborted bud galls, usually at the twig tips, which cause a check in the branch development and an ultimate stunting and malformation of the tree.

A new *Phanurus* from the United States, with notes on allied species, A. A. GIRAULT (*Canad. Ent.*, 48 (1916), No. 5, pp. 149, 150).—*Phanurus emersoni* n. sp., reared from tabanid eggs at Dallas, Tex., and three allied species are described.

Studies in flies.—Chaetotaxy and pilotaxy of Muscidae and range of their variability in the same species, P. R. AWATI (*Indian Jour. Med. Research*, 3 (1915), No. 1, pp. 135-148, pls. 3, figs. 6).—The author's conclusions in regard to the importance of chaetotaxy in Musca are as follows:

"It is very unreliable and hence of little use in classification. The number of bristles on the head is very variable in the same species; their arrangement, however, in some cases seems to be specific, as in the case of the facial bristles. The thoracic bristles show generic variations and hence are important in distinguishing Musca from other genera of the same family."

New genera and species of Australian Muscoidea, C. H. T. TOWNSEND (*Canad. Ent.*, 48 (1916), No. 5, pp. 151-160).

The development and auto-destruction of house flies in horse manure, E. ROUBAUD (*Compt. Rend. Acad. Sci. [Paris]*, 161 (1915), No. 11, pp. 325-327).—The author reports investigations carried on at the central laboratory of the army.

He first calls attention to the fact that horse dung is the best medium for the development of house flies, it being estimated that the dung from a single animal is sufficient for the development in summer of from 40,000 to 50,000 per month, or from 160,000 to 200,000 from June to September. It appears that after scarcely 24 hours fermentation definitely protects the dung against oviposition therein. The use of certain antiseptics and larvicides, such as borax, solutions of cresyl, and ferric and ferrous sulphates, retards fermentation, thus prolonging the period in which oviposition may take place from one to two days, and in this way multiply the chances of infestation of the dung. By the end of the sixth day manure placed in heaps had apparently been vacated by the larvae, which had migrated for pupation.

Larvae of the house fly placed in manure at a temperature of 50° C. (112° F.) exposed to the gas formed by fermentation die in three minutes. In direct contact with the gas at a temperature of 51° death takes place in one minute, at 59° in from five to seven seconds, and at 60° in from four to five seconds.

Soluble poisons in the poisoned bait spray to control the adult of the apple maggot (*Rhagoletis pomonella*), H. H. P. SEVERIN (*Maine Sta. Bul.* 251 (1916), pp. 149-168, fig. 1).—Experiments conducted during 1914 and 1915 are reported.

No conclusions can be drawn on the effectiveness of the poisoned bait spray from any of the experiments performed during 1914 due to the fact that the different soluble poisons scorched the leaves and therefore insoluble arsenicals were then substituted. A series of experiments with different amounts of soluble poisons, such as potassium and sodium arsenate and sodium arsenite, show that as small a quantity as 0.25 oz. of these insecticides dissolved in boiling water and then added to 3 gal. of water with one pint of molasses will burn the foliage of the apple trees.

"In 1915, during a very rainy season, the results obtained with three applications of the poisoned bait spray containing a soluble poison dissolved in diluted molasses [potassium arsenate 0.75 oz., molasses 1 pint, and water 3 gals.] showed that the infestation varied from 0 to 20 per cent in orchards situated away from the margin of the experimental area, and from 32 to 57 per cent in orchards near untreated trees. An even distribution of the droplets over the foliage is more effective than spraying the trunk, large limbs, and foliage of the lower branches. The number of applications necessary to insure good results can not be stated with this work still in its experimental stage. In orchards where tent caterpillars have practically stripped or partially defoliated the trees the poisoned bait with the use of a soluble poison can not be advocated.

In orchards where tent caterpillars are controlled, defoliation caused by spray injury is far less than the damage caused by these pests in neglected orchards. Our experience shows that after fruit growers have been convinced of the results obtained by the use of the poisoned bait spray, many prefer sound fruit even if burned foliage is the necessary price.

"The fruit fly remedy has been a complete failure in the control of the pest under town conditions. With four applications of the spray the infestation varied from 4 to 98 per cent."

Dangerous hard backs, H. A. BALLOU (*Agr. News [Barbados]*, 15 (1916), No. 359, pp. 42, 43, figs. 5).—An account of the more important lamellicorn grubs occurring in the West Indies.

Second report on insecticides for the control of the Colorado potato beetle (*Leptinotarsa decemlineata*), L. B. SMITH (*Virginia Truck Sta. Bul.* 17 (1915), pp. 369-376).—This paper gives the results of the second season's experiments in the control of the Colorado potato beetle. These results are said to confirm the more important points of the work done the previous season (E. S. R., 33, p. 358).

The mixture of homemade Bordeaux 50 gal., arsenate of lead 4 lbs., and Paris green 1 lb., continued to give excellent results. Arsenite of zinc paste at the rate of 2 lbs. to 50 gal. of Bordeaux also proved very efficient. Calcium arsenate was tried this year and the results indicate that it may prove valuable for the purpose. Several of the proprietary insecticides that were used gave returns that compared favorably with the home-prepared mixtures in efficiency. The price of arsenic oxid varied according to the form in which it was obtained, costing 24½ cts. per pound in the calcium arsenate powder and 51½ cts. in powdered lead arsenate.

Sulphur-arsenical dusts against the strawberry weevil (*Anthonomus signatus*), T. J. HEADLEE (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 84-89, fig. 1).—Substantially noted from another source (E. S. R., 35, p. 304).

Life history of the pecan twig girdler, *S. W. BILSING* (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 110-115).—The eggs of *Oncideres texana* hatch in from 17 to 30 days after deposition. The larvæ then burrow in the girdled twigs until the following summer, or for a period of from 288 to 328 days. Pupation takes place during the latter part of August and the first part of September, the pupal stage which lasts from 12 to 14 days being passed in the larval burrow.

It was found that where forests are located near a pecan orchard and it is impractical because of migration from other trees in pecan trees, to gather up the fallen twigs and burn them in order to kill the larvæ, they may be effectually dealt with through the use of arsenate of lead.

The German genera and species of the Ichneumonid tribe Anomalini, O. SCHMIEDEKNECHT (*Naturw. Ztschr. Forst u. Landw.*, 14 (1916), No. 3-4, pp. 97-116, figs. 4).—A synopsis of the forms of this important tribe (parasites of Lepidoptera) which occur in Germany.

Note on an interesting case of two generations of a parasite reared from the same individual host, P. H. TIMBERLAKE (*Canad. Ent.*, 48 (1916), No. 3, pp. 89-91).—The author records the rearing of two generations of the braconid parasite *Dinocampus americanus* from the convergent lady beetle (*Hippodamia convergens*). This shows that this parasite does not injure the vital organs of its host.

The European Trichogramminæ, with particular consideration of their practical importance as parasites, M. WOLFF (*Ztschr. Forst u. Jagdw.*, 47 (1915), Nos. 8, pp. 474-497; 9, pp. 543-568, figs. 24).—A synopsis of the European forms of this important subfamily of parasites.

A preliminary report on the life economy of *Solenopsis molesta*, J. W. McCOLLOCH and W. P. HAYES (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 23-38, pl. 1, fig. 1).—A report of biological and economic studies of the Kafir ant (*S. molesta*), which in Kansas destroys the seed of Kafir corn, cane, milo maize, and feterita. The most practical control measures in southern Kansas consist in fall plowing and thorough spring harrowing, as well as surface and early planting of the crop.

Spraying versus beekeeping, B. N. GATES (*Mass. Bd. Agr., Apiary Insp. Bul. 10A* (1916), pp. 22, pls. 2).—This paper reviews the literature and reports instances of losses of bees occasioned by their working upon fruit trees, etc., that were sprayed while in bloom.

Fifth and sixth annual reports of the state inspector of apiaries for the years 1914 and 1915, B. N. GATES (*Agr. of Mass.*, 62 (1914), pp. 407-415, pl. 1; 63 (1915), pp. 111-158, pls. 3; *Mass. Bd. Agr., Apiary Insp. Buls.* 9 (1915), pp. 11, pl. 1; 10 (1916), pp. 30, pls. 3).—The most recent of these reports, which are along the lines of previous years (*E. S. R.*, 32, p. 556), includes an appendix giving the paper above noted on Spraying v. Beekeeping.

Is the hive a center for distributing fire blight? Is aphid honeydew a medium for spreading blight? H. A. GOSSARD (*Jour. Econ. Ent.*, 9 (1916), No. 1, pp. 59-64, pls. 2).—The tests here reported "prove conclusively to us that the blight organism, in honey, can remain sufficiently virulent for 47 hours to produce infection, with the extreme time measure of virulency probably not reached. Tests of this kind were made with fresh apple honey and also with well-ripened honey taken from the hive in midsummer and the results were substantially the same. It is evident from these results that the formic acid of honey is not immediately fatal to the blight organism. . . . We believe we have proved that if one bee carries 100,000 bacilli into the hive one day, that on the following one or two days, each of 1,000 bees has the possibility of carrying a considerable fraction of 100 virulent bacilli out to fruit blossoms, because practically all the bees in the hive are at work during the night curing the honey. This would seem to go a long way toward explaining the wholesale infection that occurs in the latter part of the blooming period."

The Pajaroello tick (*Ornithodoros coriaceus*), W. B. HERMS (*Jour. Parasitology*, 2 (1916), No. 3, pp. 137-142, fig. 1).—Notes are given on the life history and biting habits of this tick, based largely upon observations in California by the author and W. L. Chandler.

This tick has been found to occur in a number of counties of the State, including San Benito, Santa Clara, Stanislaus, Monterey, and Santa Barbara, and probably also Los Angeles and San Diego, thus connecting up with Mexico, which is the original habitat. It is most commonly found among dry leaves beneath live-oak trees, where cattle are accustomed to lie in the shade.

Eggs deposited March 9 hatched March 31, giving an incubation period of 21 days, at an average temperature of 26.3° C. A larva placed on the ear of a rabbit May 2 was recovered fully engorged May 11, and molted 10 days later, on May 21. The second molt, without a second engorgement, took place June 15. The nymph became fully engorged in about 20 minutes, on July 2; the third molt occurring August 12. It again engorged October 11, the fourth molt taking place December 23. After another engorgement on January 16, the fifth molt took place on March 9 and the tick appeared as a sexually mature female. On March 27 the female became fully engorged, copulation took place on April 17, and on June 10 428 eggs were deposited.

The number of molts varied from four to seven. The maximum number of eggs deposited by a tick in one season was 1,158, there being seven separate layings.

Both nymphs and adults readily attached to man, monkey, rabbit, and mouse, and became fully engorged in from 15 to 30 minutes. A sharp pain is felt at the time the bite of the tick takes place and the point of attachment remains highly irritated for several days, during which time a scab forms. An extensive swelling of the affected part may follow its bite.

FOODS—HUMAN NUTRITION.

Skim milk in human and animal nutrition, L. MALPEAUX (*Vie Agr. et Rurale*, 6 (1916), No. 23, pp. 401-407, fig. 1).—Data are given regarding the nutritive value of skim milk and its use as food for man, calves, and pigs.

The soy bean as a food material, W. SCHIEDER (*Seifensieder Zig.*, 42 (1915), No. 22, pp. 471, 472).—Descriptions and analyses are given of a number of different products prepared from the fermented and the unfermented soy bean.

Chemical composition of the fruit of the cheromayer, A. CUTOLO (*Staz. Sper. Agr. Ital.*, 43 (1915), No. 12, pp. 889-898).—Data are reported regarding the chemical composition of the pulp, skin, and seeds of this fruit, which somewhat resembles the pear.

Maté tea, O. RAMMSTEDT (*Pharm. Zentralhalle*, 56 (1915), Nos. 4, pp. 29-34; 47, pp. 708-710).—Analytical data are given regarding a number of commercial samples of maté, which is obtained from the Brazilian herb *Erica vulgaris*. The active principle of maté is mattéin, a substance identical with or closely related to caffeine. The composition of maté is also compared with that of tea and coffee.

[Analyses of] extracts and spirits (*Maine Sta. Off. Insp.* 77 (1916), pp. 21-40).—This publication reports the results of the analysis of a number of samples of extracts of peppermint, wintergreen, vanilla, lemon, etc., together with a statement regarding them by A. M. G. Soule.

[Food and drug inspection and analysis], C. L. CLAY (*Bien. Rpt. La. Bd. Health*, 1914-15, pp. 63-105, figs. 2).—Analytical data are reported regarding 2,017 samples of water, miscellaneous foods, drugs, and patent medicines. The results of the inspection of dairies are also given.

[Food inspection], A. W. J. MACFADDEN (*Ann. Rpt. Local Govt. Bd. [Gt. Brit.]*, 44 (1914-15), pp. 18-20).—This is a review of the work of the food inspectors during the year 1914-15. In addition to the routine work it included the inspection of food for the troops, a continuation of the studies of infant foods (E. S. R., 32, p. 661), the inspection of food for exports, and the investigation of several outbreaks of food poisoning.

Food and oil laws of the State of Wyoming (*Cheyenne, Wyo.: Office Dairy, Food, and Oil Comr.*, 1915, pp. 82).—The text of the laws is given, together with rules and regulations adopted by the food commissioner, and the standards of purity for food products.

Hints on inspecting canned foods, W. D. BIGELOW (*Chem. Engin. and Manfr.*, 24 (1916), No. 3, pp. 103-110).—Among the factors stated to be of importance in the inspection of canned goods are a knowledge of the raw product and the methods and conditions of manufacture; the external appearance of the can; the odor, flavor, and appearance of the contents of the can on being opened; and the bacteriological examination.

A proposed score card for refrigerators, W. A. EVANS (*Amer. Jour. Pub. Health*, 6 (1916), No. 7, p. 743).—A score card is described which can be used by health departments, food departments, manufacturers, merchants, or housewives. The apparatus required consists of ice scales, a thermometer, a tape line, and a hygrometer. The factors considered are the temperature of the food

chamber, ice economy, humidity, circulation of air, interior finish, drainage, and exterior finish.

The bacillus carrier and the restaurant, A. I. KENDALL (*Amer. Jour. Pub. Health*, 6 (1916), No. 7, pp. 726-729).—This article considers the danger of the contamination of food by the bacillus carrier, and describes the measures taken to prevent such contamination in the restaurant of a department store when it was possible that some of the cooks and waitresses had been exposed to typhoid infection. The measures taken included thorough scrubbing of the hands before starting work and after any absence from the restaurant during the day; the application of the Widal test; and the examination of the urine and the feces.

[Care of the baby], E. F. LADD and ALMA K. JOHNSON (*North Dakota Sta. Spec. Bul.*, 4 (1916), No. 5, pp. 97-132, figs. 8).—This contains information on the care and feeding of children.

The diet of children after infancy, J. H. M. KNOX (*Jour. Amer. Med. Assoc.*, 67 (1916), No. 6, pp. 432-435).—This paper calls attention to such data as are available regarding the food requirements of young and growing children, and gives diet lists suitable for a child from 12 to 18 months and a child from 2 to 4 years of age. The author emphasizes the importance of giving more consideration to the diet of young children.

The new emergency ration [of the U. S. Army] (*War Dept. [U. S.] Ann. Rpts.*, 1915, I, pp. 271, 272).—A brief progress report of the work on the emergency ration conducted by the Office of Home Economics of the U. S. Department of Agriculture.

Report by the departmental committee appointed to inquire into the question of maintaining and if possible increasing the present production of food in Scotland, E. WASON ET AL. (*Edinburgh: Govt.*, 1915, pp. 16).—A number of recommendations are formulated.

Minutes of evidence taken before the departmental committee appointed to inquire into the question of maintaining and if possible increasing the present production of food in Scotland (*Edinburgh: Govt.*, 1915, pp. 166).—This publication contains the minutes of the hearings and other evidence upon which the above report was based.

The normal gastric secretion, M. E. REHFUSS (*Proc. Amer. Phil. Soc.*, 55 (1916), No. 6, pp. 461-470).—In this article the author brings together a great deal of information regarding the normal secretion of the gastric juice which has been obtained in a number of experiments by himself and other investigators, notably Hawk, Bergeim, Fowler, Spencer, Clarke, and others. The bulk of the material has been noted from other sources.

The uric acid solvent power of normal urine, H. D. HASKINS (*Jour. Biol. Chem.*, 26 (1916), No. 1, pp. 205-215).—The experimental data here reported may be summarized briefly as follows:

"When shaken with uric acid for 20 minutes at 37° C. many urines that are slightly acid and all that are neutral or alkaline take up extra uric acid. The less acid the urine the more uric acid, as a rule, it will dissolve. Dilute urines when considered in proportion to their concentration show much greater solvent power than less dilute urines.

"Some urines dissolve so much uric acid that they come to contain more uric acid than is present in a saturated solution of monosodium urate. In all probability in these cases at least part of the uric acid is in colloidal solution."

Creatin in human muscle, W. DENNIS (*Jour. Biol. Chem.*, 26 (1916), No. 2, pp. 379-386).—Employing the method of Folin, the author studied the creatin content of samples of muscle obtained at the autopsies of 5 normal individuals and 72 individuals dying from various diseases. Determinations were also made of the creatin in muscles obtained from several autopsies of children.

From the results reported it appears that "the fact that the muscle of children contains much less creatin than that of adults was confirmed." These results apparently confirm the theory concerning the relationship of muscle creatin and urinary creatinin in man offered by other investigators, who have called attention to the low creatinin coefficients in the case of persons in a feeble and wasted condition; as such individuals become convalescent and show an increase in the "muscle tonus" a rise in the creatinin coefficient is noted.

The creatinin and creatin content of the blood of children. B. S. VELDER and M. R. JOHNSTON (*Amer. Jour. Diseases Children*, 12 (1916), No. 2, pp. 136-144).—This paper reports experimental data regarding the content of creatin, creatinin, and nonprotein nitrogen in the blood of children under normal and clinical conditions. The data are based upon experiments made with 75 children.

Experimental studies on creatin and creatinin.—V, Protein feeding and creatin elimination in pancreatic diabetes, W. C. ROSE (*Jour. Biol. Chem.*, 26 (1916), No. 2, pp. 331-338).—The author reports experiments in continuation of earlier work on the influence of diet on the elimination of creatin and creatinin (E. S. R., 26, p. 158).

Experiments with laboratory animals (dogs) showed that protein feeding in the animals after complete extirpation of the pancreas did not lead to the disappearance of creatin from the urine, as was the case with similar feeding in normal fasting animals. In the opinion of the author the behavior of the creatin elimination in phlorizin and pancreatic diabetes offers proof of the dependence of the creatin elimination upon the carbohydrate utilization.

Experimental studies on creatin and creatinin.—VI, Protein feeding and creatin elimination in fasting man, W. C. ROSE, F. W. DIMMITT, and P. N. CHESTNUT (*Jour. Biol. Chem.*, 26 (1916), No. 2, pp. 339-344).—The results are reported of observations upon two normal, healthy young men receiving a diet of eggs after a period of fasting. The following conclusions are drawn:

"Contrary to the generally accepted idea, protein feeding in starving man promptly reduces the creatin output to nil.

"The amount of acetone bodies present in the urine during short fasts (three to four days) is not sufficient to render the creatin-creatinin figures unreliable. Four times the quantities of acetone and diacetic acid eliminated in the present experiments were entirely without effect upon the creatinin readings."

Experimental studies on creatin and creatinin.—VII, The fate of creatin and creatinin when administered to man, W. C. ROSE and F. W. DIMMITT (*Jour. Biol. Chem.*, 26 (1916), No. 2, pp. 345-353).—Excessively large doses of creatin and creatinin were fed to individuals in nitrogen balance and the effect observed on urinary composition, particularly with reference to the output of urea. The following conclusions are drawn:

"The ingestion of large doses (20 gm.) of creatin in man leads to a very perceptible increase (0.30 to 0.45 gm.) in the output of creatinin. This increase in urinary creatinin is attributed to a conversion of creatin into its acylhydrid, and not to an increase in the output of endogenous creatinin.

"The ingestion of large doses (16 gm.) of creatinin is not followed by the appearance of creatin in the urine. This indicates that the reaction Creatin→Creatinin+Water is probably not a reversible one in the human organism.

"No evidence was obtained indicating a transformation of creatin or creatinin into urea by the body cells. On the contrary, urea is probably not a catabolic product of these substances."

The physiological action of glucal. J. O. BALCAR (*Jour. Biol. Chem.*, 26 (1916), No. 1, pp. 163-171).—This investigation was made in view of the fact

that glucal is so closely related to glucose and may possibly be an intermediate stage of glucose metabolism. In addition to studying the chemical characteristics of glucal, experiments were carried out with various laboratory animals which showed that glucal is not toxic, produces no effect on blood pressure or on respiration when injected intravenously in moderate quantities, and is not completely metabolized by the animal body when injected at the rate of 0.9 gm. per kilogram of body weight per hour.

The lipoids ("fat") of the blood in diabetes. W. R. BLOOR, E. P. JOSLIN, and A. A. HONOR (*Jour. Biol. Chem.*, 26 (1916), No. 2, pp. 417-430).—The observations here reported show in part that "in severe diabetes the blood lipoids were all markedly increased, up to 100 per cent or more of the normal values. In mild diabetes the lipoids may be normal. In general, the more severe or long standing the diabetic condition, the more marked was the abnormality in the blood lipoids.

"In spite of the high values, the relations between the lipoids were practically those of normal individuals, indicating that the fat metabolism was essentially normal."

For earlier work, see previous notes (E. S. R., 34, pp. 502, 563).

Pellagra—a critical study. J. AULDE (*Med. Rec.* [N. Y.], 90 (1916), No. 5, pp. 181-185).—The author advances the theory that the essential factor in the production of pellagra, scurvy, and beri-beri is the mineral deficiency in the protein molecule, and that calcium depreciation is responsible for pellagra.

Preliminary observations on metabolism in pellagra. A. HUNTER, M. H. GIVENS, and R. C. LEWIS (*Pub. Health Serv. U. S. Hyg. Lab. Bul.* 102 (1916), pp. 39-67).—Data are given regarding the amount of indican excreted and the nitrogen balances in the case of a number of inmates of the pellagra hospital at Spartanburg, South Carolina.

Pellagra.—The value of the dietary treatment of the disease. J. R. RIMMON (*Pub. Health Rpts.* [U. S.], 31 (1916), No. 30, pp. 1979-1999).—This report is based on observations upon 58 pellagra patients in the U. S. Marine Hospital at Savannah, Ga. The patients were given a diet relatively rich in animal and leguminous protein component and relatively poor in nonleguminous-vegetable component. It is concluded from these cases that the dietetic treatment of pellagra is of paramount importance, and "that in this series success has followed the use of a diet in which the animal and leguminous-protein component has been relatively increased and the nonleguminous-vegetable component relatively decreased."

As a part of the histories of the pellagra patients an attempt was made to ascertain the diet consumed during the three months previous to the appearance of the disease. The data collected from 35 patients are reported in this article. "A study of these diet histories shows that the vegetable and fat components were notably conspicuous and that the animal protein foods were relatively inconspicuous."

The energy metabolism of a cretin. F. B. TALBOT (*Amer. Jour. Diseases Children*, 12 (1916), No. 2, pp. 145-148, fig. 1).—The heat production of a cretin, 3 years 8 months old, was determined by the calorimeter to be 898 calories per square meter of body surface, or 40.5 calories per kilogram body weight.

ANIMAL PRODUCTION.

Meat situation in the United States, I-IV (*U. S. Dept. Agr. Rpts.* 109 (1916), pp. 307, pl. 1, figs. 31; 110 (1916), pp. 100, pls. 6; 111 (1916), pp. 64, pls. 5, figs. 2; 112 (1916), pp. 27).—This portion of the report is treated in four parts.

I. *Statistics of live stock, meat production and consumption, prices, and international trade for many countries*, G. K. Holmes.—This treats of the number of meat animals in the United States and other countries, meat exports and imports, production and consumption, losses of meat animals, prices, meat-producing conditions in other countries, and conditions and problems in the United States. Under this last heading are treated local origin of cattle for slaughter and feeding, age of beef cattle, yearly marketings of meat animals, yearly slaughterings at principal places, increase of retail over wholesale price, and 1-year tenancies.

II. *Live-stock production in the eleven far western range States. Based on reports from stockmen and county correspondents*, W. C. Barnes and J. T. Jardine.—The data contained in this report are based upon studies made in the summer of 1914 of conditions in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

The studies show that in these 11 States there was an estimated reduction of 859,120 cattle and 4,537,578 sheep in 1914, as compared with 1910. Considering four sheep as the equivalent of one cow, this means a reduction of approximately 13 per cent in live stock (cattle and sheep). The entry and settlement of approximately 85,500,000 acres of lands in these States since 1909 has resulted in a decrease of approximately 16 per cent in live-stock production since 1910 due to the breaking up of ranges formerly used as breeding grounds for cattle and sheep. High prices and general farm development in the range region have resulted in increased winter feeding of range live stock, thereby reducing the amount of range necessary per animal, and consequently in part offsetting the decrease due to settlement. "Uncertainty as to future conditions, difficulty of securing money for purchase of breeding stock, increase in value of land and dairy products, improvement in grade and weight of animals at the expense of numbers, drought and severe winters, and range deterioration have had some effect in bringing about decreases in numbers during a part of the period 1910-1914, but, considering this period as a whole, these factors had only a small influence in the aggregate."

As regards the possibilities of increased production in the future the investigations indicate that there will probably be an increase of 15 per cent in the next ten years, from 1915 to 1924, inclusive, because settlers on approximately 100,000,000 acres of range lands settled since 1905 will turn to raising live stock; the carrying capacity of summer range within National Forests will increase probably 15 per cent, and winter feeding adjacent to National Forest ranges will probably increase accordingly; and better management of stock, both on farms and on the range, will result in greater economy in the use of forage and, consequently, will increase the number of stock produced with a given amount of forage.

From a study of the cost of production, it is concluded that for sections of the West where winter feeding is practiced the man who contemplates substituting live stock for other forms of agriculture should figure on a cost of approximately \$30 for the production of a good yearling, and \$45 for the production of a good long 2-year-old; this cost to include labor, market value of feeds, taxes, loss, bull service, and any depreciation of breeding stock. In sections of these same States where only a part of the stock is fed in winter the cost of producing a yearling may be set at approximately \$25, and of a 2-year-old at \$35. In the range sections of the Southwest the cost of producing a yearling may be set at from \$15 to \$19, varying greatly with the number of calves per 100 cows, and the cost of producing a long 2-year-old at approximately from \$20 to \$25. The average weight given for a 2-year-old steer in the feeding sections is 960 lbs. At \$45 as the cost of production, the cost per pound is about

4.6 cts. For Arizona and New Mexico the average weight of a 2-year-old steer is given as 775 lbs. At \$25 for production the cost per pound is a little over 32 cts. For the Southwest, hazard due to the exceptional loss in time of prolonged drought is not fully covered in the above costs.

On the basis of the report of the U. S. Tariff Board of 1911 together with modifications to bring the figures down to 1914, it is estimated that the cost of producing a lamb in California is \$1.55, in Arizona, Colorado, and New Mexico, \$1.71, and in Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming, \$1.82. These figures cover loss and depreciation, provide for interest on capital invested in land, improvements, and equipment, and include wool at market price.

A brief discussion is given of conditions in each State included in the investigations.

III. *Methods and cost of growing beef cattle in the corn-belt States.* J. S. Cotton, M. O. Cooper, W. F. Ward, and S. H. Ray.—The object of this study was to determine as accurately as possible the cost of producing beef animals on corn-belt farms. In order to get significant figures, 596 records were obtained from farms chosen at random in the States of Indiana, Illinois, Minnesota, Iowa, Missouri, South Dakota, Nebraska, and Kansas. An effort was made to get at least 20 records in a locality. The farms visited in the various States ranged in size from an average of 294 acres in Indiana and Illinois to 566 in Kansas. The value per acre ranged from \$59 in Indiana to \$175 in Iowa. Records were procured on 14,634 cows and 621 bulls, and on 12,591 calves produced from them, of which 2,023 were fattened for baby beef.

The records were arranged in six groups, classified as (1) beef (farms where all the cows are kept strictly for beef, but not including farms producing baby beef); (2) baby beef (farms on which the breeding herds are maintained for the production of high-grade calves which are fattened on the same farm and sold at from 12 to 18 months of age); (3) dual purpose (farms on which all of the cows are milked, and either cream or butter sold, the calves being weaned at birth and raised on skim milk); (4) mixed (farms on which the practice is to milk the best cows, their calves being weaned at birth and fed skim milk, the calves from the other cows being allowed to run with their dams as in the beef group); (5) partially milked (farms on which the calves are not weaned, but on which a part of the milk is drawn from the cow, the calf taking the remainder); and (6) double nursing (farms where some of the cows are milked and their calves given to other cows, the latter raising two calves each). The results are considered representative of the present-day operations of the corn-belt stock farm. The following table shows for the six groups the various factors that make up the cost of producing a yearling:

Summary of the various factors that make up the cost of producing a yearling.

Item.	Beef.	Baby beef. ^a	Dual purpose.	Mixed.	Partially milked.	Double nursing.
Number of farms.....	230	66	110	102	65	29
Average number of cows per farm.....	31.50	34.56	12.75	23.47	14.29	15.72
Cost of maintaining the breeding herd:						
Gross cost of maintaining a cow.....	\$35.12	\$36.77	\$55.14	\$43.95	\$42.75	\$46.59
Credits other than calf.....	\$4.79	\$5.39	\$19.07	\$24.72	\$21.43	\$32.94
Net cost of maintaining a cow.....	\$30.33	\$31.38	\$36.07	\$19.23	\$21.32	\$13.65
Net cost of maintaining a bull.....	\$42.27	\$53.26	\$37.51	\$46.79	\$34.14	\$40.53
Calving crop:						
Percentage of cows raising calves to weaning time.....	84.90	90.70	83.90	87.50	90.10	92.10
Number of calves per bull.....	20.90	25.30	10.70	18.50	12.90	15.00

^a The statement for the baby-beef group gives figures on the calves until they are marketed at approximately 15 months of age.

Summary of the various factors that make up the cost of producing a yearling—Continued.

Item.	Beef.	Baby beef.	Dual purpose.	Mixed.	Partially milked.	Double nursing.
Cost of raising a calf to weaning time:						
Cow charge.....	\$35.47	\$34.50	\$7.34	\$22.29	\$23.71	\$14.53
Bull charge.....	\$2.26	\$2.29	\$4.02	\$2.51	\$3.55	\$3.02
Feed.....	\$0.01		\$9.35	\$4.48	\$0.02	\$0.26
Labor.....			\$2.56	\$1.11		\$0.01
Total cost at weaning time.....	\$37.74	\$36.79	\$23.27	\$30.79	\$27.08	\$17.82
Cost of raising a yearling:						
Number of farms.....	190	67	99	96	57	22
Average number of calves per farm.....	24.43	30.29	10.57	18.46	11.16	41.23
Cost at weaning time.....	\$38.29	\$37.01	\$23.64	\$30.61	\$26.39	\$17.82
Winter-feed cost.....	\$12.32	\$55.02	\$9.93	\$12.01	\$12.21	\$10.24
Other charges.....	\$4.02	\$9.03	\$4.92	\$1.72	\$1.66	\$3.56
Gross cost.....	\$55.14	\$78.05	\$38.49	\$47.31	\$40.26	\$31.92
Credits.....	\$1.60	\$7.53	\$1.80	\$1.48	\$1.54	\$1.07
Net cost.....	\$53.54	\$70.52	\$36.69	\$45.86	\$38.72	\$30.23

^a A change in the number of farms on which the tabulation of the cost of producing yearlings is based causes the figures on cost of calf at weaning time to change in this part of the table.

^b Italic figures here call attention to the fact that the baby-beef animal is carried somewhat beyond the yearling stage.

"The data obtained indicate that the keeping of cattle for beef purposes alone is adapted to the more extensive types of farming, while the keeping of cattle primarily for beef purposes, but where an income is also obtained from milk products, is better adapted to the more intensive types of farming.

"The averages brought out in this investigation would seem to indicate that profits obtained from the raising of calves on corn-belt farms are very small. However, the following facts must be taken into consideration: (1) Good returns have been obtained for a large quantity of roughage which, had it not been utilized by live stock, would have been waste; (2) a home market has been provided for salable crops; (3) on many farms a large acreage suitable to pasture only has been utilized; (4) profitable employment is provided for a season of the year when labor otherwise might be idle; (5) a return is obtained for capital invested in equipment which, in many instances, were it not utilized by live stock, would return nothing; and (6) when the farmer merely breaks even he has at least made 6 per cent interest on the money he has invested in the cattle business. When all of these factors are taken into consideration, even though there appears to be little or no profit, it is believed that in most cases the farm income is greater because of cattle having been kept on the farm."

IV. *Utilization and efficiency of available American feedstuffs.* W. F. Ward and S. H. Ray.—In this study the total loss to farmers from the waste of corn fodder and straw is estimated at about \$102,800,000 each year.

In 1914 about 120,000,000 tons of straw was produced in the United States. Of this, 55 per cent was fed to live stock, while 15 per cent was burned, 8 per cent sold, and 22 per cent plowed under or otherwise disposed of. It is suggested that greater publicity concerning the value of straw, its use as a filler in commercial feeds, and in various manufactures, might aid somewhat in preventing its waste.

Corn stover produced in the United States is estimated at 245,253,000 tons, of which 81.5 per cent was fed to cattle and other stock. No data were obtained as to the percentage wasted in feeding, but is estimated as at least 35 per cent. This waste can be checked through the use of better methods for feeding fodder and stover, and it can be almost entirely stopped through the use of silos. Of the total amount of stover produced 3.7 per cent was burned, 10.2

per cent plowed under, and the rest sold or disposed of in other ways. Emphasis is put on the advantage of using as large an amount as possible of these materials for silage, only 8.1 per cent of the corn acreage now being used in this way.

To feed the large quantities of straw and stover now wasted would necessitate the feeding of large quantities of concentrated feeds which are now disposed of in a less economical manner. For instance, more than 810,000 tons of cotton-seed meal was used in six southern States in 1914 for fertilizer. If this had been fed to live stock and the manure used for fertilizer the value of the meal would have been increased from 50 to 85 per cent. This is true of all the oil meals used for both fertilizer and feeding purposes. The food value of these concentrated protein materials can be further increased through the more extensive use of silage.

A nation-wide campaign to teach the value and use of food-unit values for all the more common feeding stuffs is advocated.

More experimental study of spineless cactus as a feeding stuff is suggested. Common sugar cane and Japanese sugar cane are regarded as very promising forage crops for the extreme South, while the utilization of the by-products of sugar cane, such as cane tops, bagasse, and blackstrap molasses, may afford large savings in the cane-growing section. Feterita and Sudan grass are deemed promising for the semiarid West, Sudan grass as an important hay crop in other sections of the country, and teosinte in the extreme South.

Silage crops are deemed more economical than roots and serve almost the same purpose. The animal by-products, such as tankage, fish meal, etc., are excellent feeds for hogs, but are little used for cattle. Dried brewers' grains and distillers' by-products are in general use and are generally fed with care. Improvements could probably be made in the method of feeding the slop by the use of other concentrated feeds and some dry roughage. Canning factory refuse could be increased in value by storing in silos rather than in huge piles in the open. Beet pulp is usually handled in an economical manner and comparatively little of it is wasted.

Investigation in animal nutrition: Beef production, T. L. HAECKER (Minnesota Sta. Bul. 155 (1916), pp. 3-31).—During the winter of 1907-8 a series of experiments was inaugurated with beef-bred calves to determine their composition by making a complete chemical analysis of a fairly representative one at each period of 100 lbs. gain in weight, and also to keep a complete record of all food consumed by each animal and the dry matter and digestible nutrients required for production to the various stages of growth. The records of five groups are given and commented upon.

The calves received from 8 to 10 lbs. of whole milk per day for two or three weeks, according to the judgment of the feeder, and then a gradual change was made to separator skim milk. The roughage fed was choice upland prairie hay and corn silage. The concentrates were farm grains and their standard by-products, such as bran, flour middlings, and oil meal. All the steers were kept in the barn during their lifetime, except that half the steers from three groups were turned to pasture when they were one year old. During the first year they were all kept in small portable stalls. During the second year those that were retained in the barn on continuous stall-feeding had the freedom of a runway in the barn and were confined in portable stanchions only while they were eating their rations. Each steer always received as much hay and silage as he would eat, and the amount of grain required was determined by the feeder. The following table presents data based on the average of all the

steers in the five groups, showing the growth during the various stages and the feed requirements found necessary to convert a calf into a 1,200-lb. steer, ready for market, in approximately two years:

Average weights and gains per steer, feed consumed and total cost of feed consumed per steer, and cost per pound of gain.

Period.	Weight.	Gain.	Milk.	Skim milk.	Grain.	Hay.	Silage.	Total cost of feed consumed.	Cost per pound of gain.
<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>		<i>Cents.</i>
100.....	111.7	40	244	40	106.6	.....	.....	\$3.28	10.6
100-200.....	199.2	87.5	216	879	.....	.....	.....	.....	.....
200-300.....	29.6	100.1	.....	577	198.1	236.7	6.9	6.58	7.5
300-400.....	91.6	102.0	.....	163	258.0	237.7	332.3	4.91	4.9
400-500.....	302.5	100.9	.....	.....	301.9	333.8	476.8	5.11	5.0
500-600.....	601.5	99.0	.....	.....	286.8	319.4	417.1	5.56	5.5
From calf to 12 months.....	.....	489.8	460	1,659	1,138.4	1,294.2	1,365.1	5.24	5.3
600-700.....	998.3	98.8	.....	.....	354.6	430.5	396.6	30.71	6.3
700-800.....	809.2	101.9	.....	.....	451.3	515.2	121.1	6.34	6.5
800-900.....	901.4	101.2	.....	.....	575.9	557.5	377.0	7.62	7.5
900-1,000.....	1,000.6	99.2	.....	.....	551.0	459.2	603.4	9.58	9.5
1,000-1,100.....	1,100.1	99.5	.....	.....	625.6	446.6	871.3	9.19	9.3
1,100-1,200.....	1,200.9	100.8	.....	.....	739.8	490.5	871.5	10.04	10.0
From 12 to 24 months.....	.....	599.4	.....	.....	3,268.2	2,899.5	3,240.9	11.34	11.2
From calf to 24 months.....	.....	.....	460	1,659	4,496.6	4,193.7	4,606.3	54.11	9.0
1,200-1,300.....	1,302.5	101.6	.....	.....	811.5	786.0	1,064.4	84.82	7.8
1,300-1,400.....	1,400.6	98.1	.....	.....	833.3	770.0	1,176.0	14.62	14.4
1,400-1,500.....	1,500.0	96.4	.....	.....	905.8	560.0	1,736.0	14.91	15.2
From calf to 1,500 lbs.....	.....	1,388.3	460	1,595	7,030.2	6,309.7	8,582.7	15.37	15.4
								129.72	9.3

Data on two of the groups turned out to pasture as yearlings are given. Their weight as yearlings averaged 601.9 lbs. The steers were returned at the proper time, weighing an average of 707.6 lbs., and after a week's preliminary feeding were started on a feeding experiment. They were kept in an open runway, but twice a day were confined to stanchions while they were taking their morning and evening rations. The following table shows the average gains made and feed consumed:

Summary of pasture lots.

Period.	Average weight per steer.	Average gain per steer.	Grain consumed per steer.	Hay consumed per steer.	Silage consumed per steer.	Grain consumed daily per steer.	Average daily gain per steer.	Grain consumed per pound gain.
<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
700-800.....	801.8	91.2	234.8	175.0	718.2	6.40	2.645	2.40
800-900.....	904.5	102.7	324.7	207.0	1,106.0	7.10	2.276	3.18
900-1,000.....	997.6	93.1	423.3	254.4	1,355.1	8.10	1.780	4.56
1,000-1,100.....	1,092.8	95.2	513.8	340.7	1,282.6	9.20	1.699	5.41
1,100-1,200.....	1,204.4	111.6	582.7	254.5	1,309.7	10.40	1.994	5.22
Second year.....	.....	406.8	2,073.3	1,231.6	5,811.6	8.23	1.998	4.12
First year.....	.....	480.6	1,132.3	1,187.2	1,429.3	3.24	1.374	2.35

The average feed cost per steer for the first year was \$30.48 and for the second year after returning from pasture, \$35.84.

The difference in cost of production between the steers on continuous stall-feeding and those turned to pasture the second year affords data on the benefits

derived from pasture. The pastured steers of one group were in pasture 140 days and gained an average of 125 lbs. per head. During the time they were on stall feed the average cost was \$61.70. They sold for 7.75 cts. per pound, while the lot on continuous stall-feeding cost \$81.07 per head and sold for 8.25 cts. per pound. The pastured steers brought \$23.16 net per head, and the stall-fed steers \$9.38, so that the pasture saved 68.9 cts. per week on feed cost of production. The steers of the other group were in pasture 153 days and gained an average of 44.4 lbs. per head. The stall-fed steers brought an average of \$19.36 net per head, and the pastured steers \$26.26. Even under the small gain made they saved 31.4 cts. per week per head on feed cost of production.

[Animal husbandry] (*Nebraska Sta. Rpt. 1915, pp. X, XI, XV, XVI*).—In an experiment in pig feeding, carried on to determine the relative values of tankage and alfalfa hay in supplying protein to a ration in which ear corn and shelled corn were used, the results showed that the cheapest gains were made on a ration of ear corn and alfalfa hay. The addition of tankage to a ration of shelled corn and alfalfa increased the rate of gain and lowered the cost of gain when compared with shelled corn and alfalfa hay. However, this cost was higher than the cost of gains made with ear corn and alfalfa hay.

Seven lots of lambs were fed 90 days as follows: Lot 1, corn and oil meal on grass pasture; lot 3, corn, alfalfa hay, and silage; lot 4, corn, alfalfa hay, rape pasture, and turnips; and lot 6, corn and alfalfa hay in a dry lot; lots 2, 5, and 7 running in a cornfield and receiving in addition cotton-seed cake and alfalfa hay, alfalfa hay, and oil meal and alfalfa hay, respectively, after frost. The gains made varied from 0.18 to 0.27 lb. per day. The net profits for the lots 1 to 7 were \$1.22 and 97, 91, 87, 68, 68, and 66 cts., respectively. In this experiment the lambs upon grass pasture with corn and oil meal made materially better gains than any other lot. The lot running in a cornfield receiving alfalfa hay after frost did not make as favorable gains as could normally be expected, owing to disturbances while the feeding experiment was in progress.

Experiments in pork production at the North Platte substation indicate that stewing or cooking alfalfa has increased the rate of gain slightly and slightly decreased the food eaten per pound of gain. However, the cost of stewing the alfalfa probably was greater than the advantages gained. The proportions of corn, tankage, and alfalfa hay eaten from self-feeders by fall shotes during the winter, where skim milk formed a part of the ration, were corn 85.1, alfalfa hay 8.1, and tankage 6.8. The food consumed per pound of gain was corn 2.915 lbs., alfalfa hay 0.278, tankage 0.235, and skim milk 2.58 lbs.

Three lots of lambs were fed during a winter as follows: Lot 1, corn and alfalfa; lot 2, corn, alfalfa, and cotton-seed cake; and lot 3, corn, corn silage, and alfalfa. The lot fed silage made a trifle larger gain, about 2.5 lbs. per head per week. The lambs fed cotton-seed cake gave a little more profit than those fed either of the other two rations, but probably not sufficiently greater to warrant the feeding of cotton-seed cake when the price is much above \$30 per ton. Silage at \$4 per ton was so expensive that the ration containing it produced less profit than either of the other two rations. The cost per pound of gain on a ration of corn and alfalfa hay was 5.7 cts.

Hogging down soy beans and cowpeas, E. S. GOOD and M. J. SMITH (*Kentucky Sta. Bul. 201 (1916), pp. 139-149, figs. 2*).—Three lots of 90-lb. pigs were fed as follows: Lot 1, hogging down soy beans plus corn meal equal to 2 per cent of their body weight; lot 2, hogging down soy beans without corn; and lot 3, hogging down cowpeas and corn meal equal to 2 per cent of their body weight. The average daily gains made were 1.3, 0.261, and 0.303 lbs. per pig, and the cost per pound of gain, including cost of seed sown, plowing and cultivation, rent of land, labor involved in feeding, and corn consumed, was

4.54, 12.52, and 21.73 cts., for the respective lots. The total fertilizing value of the respective lots was estimated to be \$17.68, \$12.93, and \$3.61.

The results indicate that it is not profitable to hog down soy beans (grain) unless a supplementary feed is given, for only 110 lbs. of pork were produced per acre with such a procedure, which did not pay for the seed sown, cost of cultivation, and rent of land.

It was found highly profitable to hog down soy beans when a supplementary feed, such as corn, was given, for the lot of hogs receiving 2 per cent of its weight in corn meal daily produced 825 lbs. of pork per acre at a cost of 4.54 cts. per pound gain. Valuing pork at 7 cts. per pound, the net value of pork produced by this acre of soy beans was \$20.32, which, with \$17.68 for the fertility left on this acre of ground, would make a total of \$38. It was not found profitable to hog down cowpeas, even if supplemented with corn meal.

The acre of soy beans hogged off with a supplementary feed of corn produced feed for 10 hogs for 21 days and for 20 hogs for an additional 21 days. The acre of soy beans with no corn produced feed for 10 hogs for 21 days and for 15 hogs for an additional 14 days. The acre of cowpeas hogged off with a supplementary feed of corn meal given the hogs furnished feed for 15 hogs for 22 days.

Cooperative live-stock shipping associations in Minnesota, E. D. DURAND (*Minnesota Sta. Bul.* 156 (1916), pp. 5-29, figs. 3).—This bulletin treats of the general character of the cooperative live-stock shipping-association movement, the number and location of such associations in Minnesota, and their distribution and volume of business, and gives suggestions for conducting the business and method of organization, including a suggested constitution and by-laws. The text of the Minnesota laws governing cooperative associations is appended.

Stallion enrollment.—V, The stallion enrollment law and the farmer, H. E. McCARTNEY (*Indiana Sta. Circ.* 52 (1916), pp. 16, fig. 1).—An explanation of the Indiana stallion-enrollment law and the benefits of the law. It is shown that during the two years in which the law has been in operation there has been a decided increase in pure-bred stallions and jacks and a decrease in grades and scrubs.

Announcement regarding the egg-laying contest, J. J. HOOPEE and R. H. WILKINS (*Kentucky Sta. Circ.* 12 (1916), pp. 27-39, figs. 5).—This is an announcement of an egg-laying contest to be held at the Kentucky Experiment Station, beginning November 1, 1916, together with the rules and regulations governing the same.

DAIRY FARMING—DAIRYING.

[Dairying] (*Nebraska Sta. Rpt.* 1915, pp. XI-XIII).—Three years' experimental work to test the relative values of alfalfa hay and corn silage in milk production indicates that with the quality of silage and alfalfa hay which has been fed in these experiments, when corn silage is worth \$3.50 per ton to produce milk, alfalfa hay is worth \$8 per ton. This would indicate that where alfalfa hay is cheap and abundant the use of silage will not lessen the cost of milk production unless it can be produced at a lower cost than was charged for it in these experiments.

Corn silage has given more favorable results than alfalfa silage, due largely to the improper fermentation of alfalfa silage, which affected its palatability. Recent experiments have shown that a mixture of one-half green sorghum with one-half green alfalfa makes a good quality of silage, but the feeding value of this mixture has not been compared with corn silage.

A plan for a soiling crop on the basis of ten cows and adapted to Nebraska conditions is given. Experiments indicate that milk fat produced from soiling crops will be more expensive than where produced upon silage or pasture. Among the soiling crops used alfalfa produced milk and milk fat at the lowest cost.

The feeding of dairy cows, H. RABILD, H. P. DAVIS, and W. K. BRAINERD (*U. S. Dept. Agr., Farmers' Bul. 743 (1916), pp. 23*).—This discusses the factors involved in the economical selection of feeds and methods of feeding, including a discussion of various feeding stuffs and suggested rations.

Cost of milk and fat on pasture and in stable (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm., 41 (1915), p. 31*).—During the months of June, July, August, and September 32 cows were pastured and 15 cows were fed in the stable on rations identical with those used in the winter. The results were that group 1 produced milk at an average of 45.1 cts. per 100 lbs. and butter fat at 11 cts. per pound, and group 2, milk at 86 cts. per 100 lbs. and butter fat at 22 cts. per pound.

Fourth report on the cost of food in the production of milk in the counties of Kent and Surrey, G. H. GARRAD (*Southeast. Agr. Col. Wye, Rpt. Cost Food Prod. Milk 4 (1915), pp. 95*).—This is a continuation of work previously noted (*E. S. R., 33, p. 276*). Data on the cost of feed in the production of milk for the period from May 1, 1914, to May 1, 1915, and a brief summary of the results of the past three years' work are given.

It appears that the more milk a cow gives the cheaper becomes the cost of feed per gallon, and the most economical herds are those that yield well on a normal ration. There was a difference of about 5.5 cts. per gallon (nearly 12.5 cts. per day) between the cost of feeding in the six summer months (May 1 to October 31) and the six winter months (November 1 to April 30), the figures being 5.84 cts. per gallon in the summer and 11.32 cts. in the winter. The effect of a dry summer is felt not merely in increasing the cost of production of summer milk, but also in increasing the cost of the winter milk, because the natural result of a dry summer is a short crop, i. e., an expensive crop, of roots and fodder.

In every year the cost of feeding, per gallon, has been half as much again on the most expensive farm as on the cheapest farm. The 16 cheapest herds (7.08 cts. per gallon) cost 16.28 cts. per cow per day for feed and averaged 2.3 gal. of milk. The 16 most expensive herds (10.06 cts. per gallon) cost 21.82 cts. per cow per day and averaged 2.17 gal. of milk.

Cost of food in the production of milk, C. CROWTHER and A. G. RUSTON (*Univ. Leeds and Yorkshire Council Agr. Ed. [Pamphlet] 88 (1913), pp. 32; 91 (1914), pp. 40; 98 (1915), pp. 37, pls. 2*).—In these reports data are given on the production of milk in ten herds under study, the value of the milk, the feed consumed, the cost of feeding, and the milk-fat percentage. See also a previous note (*E. S. R., 29, p. 278*).

Announcement of the California state dairy cow competition, 1916-1918. F. W. WOLF (*California Sta. Circ. 153 (1916), pp. 8*).—An announcement of and regulations governing a dairy-cow competition to be held at the College of Agriculture of the University of California are given.

The bacteria of milk freshly drawn from normal udders, ALICE C. EVANS (*Jour. Infect. Diseases, 18 (1916), No. 5, pp. 437-476*).—This study included 192 samples of milk from 161 cows of five different dairies in two widely distant sections of the country. No consideration was given to those types of bacteria which occurred in the udder in small numbers. All the cultures which were studied in detail and included in this report represent bacteria which were multiplying in the udder and were found in the milk in considerable numbers.

In 32 samples, bacteria were not multiplying in numbers worth considering. Three types of bacteria were found commonly present in milk from all five dairies; they were streptococci, staphylococci, and bacilli. The ordinary milk-souring organism, *Streptococcus lacticus*, was not found in any of the samples of milk. It does not appear to localize and multiply in the udder. Long-chained streptococci which failed to give the reduction of litmus in milk cultures characteristic for *S. lacticus* were isolated from 29 samples. The highest number found per cubic centimeter was 264,000. Micrococci were found in 113 samples, the highest number found per cubic centimeter being 80,000.

The majority of the micrococci were shown to belong to one group, which agrees in characteristics with the pyogenic staphylococci. The majority of cultures of this type were nonvirulent, but some cultures were virulent, and two cultures possessed such a high degree of virulence that inoculated rabbits died in about 16 hours. Three other types of micrococci from the udder gave reactions which differed from those of the pyogenic staphylococci sufficiently to separate them into distinct groups. One of these groups is described, but no name is suggested for it because of the small number of cultures studied. Another group was identified with *Micrococcus luteus*, according to Winslow's classification. The third group was characterized by the rapid and complete peptonization of milk, and the name *M. caseolyticus* is suggested for this group.

Peculiar strains of the types of bacteria commonly present in freshly drawn milk were sometimes found localized in the udders of several cows of one dairy. A few cases were found of peculiar species, unlike any of the other udder organisms, localized in this same way.

The bacilli commonly present in milk from all five dairies were shown to be related to *Bacillus abortus*. Three varieties of this type were distinguished. The variety occurring most frequently was designated *B. abortus*, variety *lipolyticus*, because it decomposes milk fat. In its cultural characteristics this variety agrees closely with Bang's original description of *B. abortus*. Cultures of this variety were shown to be capable of imparting undesirable flavors and odors to cream kept under conditions to which cream is frequently subjected. Two other varieties of *B. abortus* type differed considerably from the *lipolyticus* variety, but resembled the cultures isolated from pathogenic sources and studied for comparison. Cultures of *B. abortus* type were isolated from 45 of the 192 samples studied. The highest number of these bacilli found per cubic centimeter was 50,000.

The author concludes that "there is a definite udder flora comprising bacteria which belong to parasitic types. It is not surprising that the majority of udder bacteria should be of the same type as those common on the skin and mucous membrane of man and animals. The majority of the staphylococci on the skin are of the nonvirulent variety, which fails to produce pigment and fails to ferment mannite. But pathogenic varieties also are found on the skin, where they ordinarily cause no trouble. Similarly, the majority of the staphylococci of the udder are nonvirulent, but varieties which are capable of causing death when inoculated into experimental animals occasionally establish themselves in healthy udders. Whatever the variety may be, conditions in the udder are favorable to multiplication, and frequently large numbers are eliminated in the milk.

"The pathogenic properties of the streptococci and bacilli common in milk when it leaves the udder are not discussed in this paper, but they also are parasitic in their nature.

"When a bacterial culture is tested for its pathogenic properties the body tissues and fluids are exposed directly to the toxins of the culture in question. When organisms enter into the digestive tract with the food the circumstances

are different, for the body tissues and fluids are protected by the mucous membranes against the ravages of the bacteria that enter with the food. Therefore it can not be assumed that bacteria which are pathogenic to inoculated laboratory animals would be injurious to human beings when present in the milk consumed. It is a subject worthy of investigation. But since the bacteria of the udder are parasitic in their nature, and since pathogenic varieties are sometimes eliminated in considerable numbers from healthy udders, the data here reported add evidence to the growing conviction that all milk is safer for consumption after it has been pasteurized."

Studies on the formation of gas in milk, B. W. HAMMER (*Iowa Sta. Research Bul. 27 (1916), pp. 3-16, figs. 3*).—Gas forming organisms were isolated from several cases of gassy curds and their action on milk both alone and in combination with *Bacterium lactis acidii* was studied.

"The curds secured with the gas formers alone did not resemble the original curd, since but a small amount of gas was held in the curd, while double inoculations gave extremely gassy curds. It is probable that the gassy curds occur with the double inoculations, because a firm curd which will retain the gas results from the acid produced by *B. lactis acidii* while the gas formation is still in progress. On continued transferring the gas formers lost their ability to produce extremely gassy curds when grown in combination with *B. lactis acidii*, and this was accompanied by a decreased acid production in inoculated milk held at 37° C. for one week. It seems likely that the decreased acid tolerance is responsible for the failure to produce extremely gassy curds. Other cultures of gas formers grown in combination with *B. lactis acidii* failed to produce extremely gassy curds, probably because of their failure to grow in the presence of acid. Cultures of *B. lactis acidii* from different sources seemed to be equally effective in the production of gassy curds when grown with the gas formers isolated.

"*B. lactis acidii* influenced the total amount of gas produced by the gas former, sometimes increasing it and sometimes decreasing it at 37°, and always decreasing it at room temperature. *B. lactis acidii* influenced the type of curd formed very materially because of the part it played in causing a retention of the gas.

"The gas-forming organisms from the four cases described were not all the same. *B. communior* and *B. ørogenes* were the two types encountered."

Comparison of the bacterial count of milk with the sediment or dirt test, H. C. CAMPBELL (*U. S. Dept. Agr. Bul. 561 (1916), pp. 6, pl. 1*).—The author gives results of an experiment to determine whether the sediment or dirt test can be wholly relied upon as a means of detecting insanitary milk at milk receiving stations. In the experiment the Gerber, the Wizzard, and the Lorenz (*E. S. R.*, 23, p. 180) apparatus were used. Pint samples of milk were collected on the railroad station platform from the milk cans as they arrived from various farmers. After preparing plates, sediment tests were made and the disks were compared with the bacterial counts.

Comparing the bacterial count with the Gerber sediment test with unfiltered market milk, it was found that "some samples had a high bacterial count, yet tested 'good' or 'fair' with the sediment test, while others which had a low bacterial count tested 'medium' or 'bad.'" With the Wizzard sediment test, one sample classed as "good" by the sediment test contained 4,102,000 bacteria per cubic centimeter, while another classed as "bad" contained only 243,000 bacteria per cubic centimeter. With the Lorenz sediment test one sample with a bacterial count of 768,000 tested "fair" by the sediment test, and one with a count of 7,200 bacteria per cubic centimeter tested "bad."

In comparisons with filtered milk 10 samples out of 20 filtered through 4-ply cheesecloth varied in bacterial count from 24,000 to 638,000 per cubic centimeter. Ten average samples out of 20 filtered through one ply of Canton flannel varied in bacterial count from 18,000 to 316,000 per cubic centimeter. Ten average samples out of 20 filtered through 1-ply ordinary absorbent cotton, covered above and below with 1-ply cheesecloth, varied in bacterial count from 31,400 to 760,000 per cubic centimeter. Every sample of filtered milk was classed as good by the Lorenz sediment test.

It is concluded that the result of a sediment test is no criterion as to the kind or number of bacteria contained in the milk. The various sediment tests, while applicable in roughly estimating the quantity of sediment in unstrained milk, can not be used as the sole means of determining the hygienic conditions under which the milk was produced. Sediment testers are deemed of little value in estimating the degree of contamination in milk strained through the substances mentioned. The Lorenz apparatus is considered the most convenient and practical for demonstrating dirt in milk.

The grading of milk. E. KELLY (*Hoard's Dairyman*, 52 (1916), No. 1, pp. 1, 6, figs. 3).—A discussion of the history and development of the grading of milk, reasons for grading, and systems of grading.

Sanitary condition of dairies (*U. S. House Representatives*, 64 Cong., 1 Sess., *Hearings before Committee on Rules on House Resolution 137*, 1916, pp. 101).—This reports hearings before a House committee as to the sanitary condition of dairies in the United States.

A new pasteurizing apparatus for bottled milk. WEIGMANN, A. WOLFF, M. TRENSCH, and M. STEFFEN (*Milchw. Zentbl.*, 44 (1915), Nos. 13, pp. 193-202, figs. 2; 14, pp. 209-217).—An apparatus for the pasteurizing of bottled milk, based on the "holder" method is described, together with data on its efficiency in bacterial destruction.

The biorizator. ORLA-JENSEN (*Milchw. Zentbl.*, 44 (1915), No. 18, pp. 273-277, fig. 1).—The biorizator method and apparatus for pasteurizing milk is described and data given showing its efficiency in reducing the bacterial content without detriment to the quality of the milk.

Biorized milk. K. E. F. SCHMITZ (*Milchw. Zentbl.*, 44 (1915), No. 16, pp. 241-245, figs. 3).—A discussion of the biorizator and its efficiency in bacterial destruction.

Result of the Lobeck method of milk sterilization (biorization). K. E. F. SCHMITZ (*Ztschr. Hyg. u. Infektionskrankh.*, 80 (1915), No. 2, pp. 233-260, figs. 5).—Experiments with the Lobeck biorizator indicated that it is an effective method of sterilizing milk without impairing the quality, taste, or nutritive value. It was effective in destroying tubercle bacilli.

A simple steam sterilizer for farm dairy utensils. S. H. AYERS and G. B. TAYLOR (*U. S. Dept. Agr., Farmers' Bul.* 748 (1916), pp. 11, figs. 8).—A simple and inexpensive yet efficient steam sterilizer is described which can be provided at a cost of from \$5 to \$10. It is believed that the sterilizer described is cheap enough to justify its use on any farm from which milk or cream is sold. It is designed to be of greatest use to those who have one, two, or three 10-gal. or smaller cans with a similar number of pails and a strainer cloth, but can be used with a larger number of cans.

When properly operated this sterilizer destroys practically all the bacteria in the utensils, including all disease germs which may be present. It will accomplish the same results as any sterilizer in which steam not under pressure is used. Experiments with this sterilizer show that the 5-minute steaming is, for practical purposes, as good as the 15- to 30-minute steaming usually recommended.

Dry milk or cream powder and a process for its manufacture, S. A. VASEY and U. A. CLEEVE (*English Patents*, 2772 (1915); 7766 (1915); *abs. in Jour. Soc. Chem. Indus.*, 35 (1916), No. 11, pp. 649, 650).—"The particles of a milk or cream powder are coated with a layer of an odorless, liquid hydrocarbon which is nonvolatile at ordinary temperature (e. g., Paraffinum liquidum, B. P.); the product will keep unaltered for a considerable period. Such a powder is produced by projecting milk powder by means of an air blast into an atomized spray of the hydrocarbon, or by mixing the milk, or partially evaporated milk, with the hydrocarbon and then drying the mixture. The finished product should contain not more than 5 per cent of its weight of the hydrocarbon."

VETERINARY MEDICINE.

The third and fourth reports of the director of veterinary research, A. THEILLER (*Rpts. Dir. Vet. Research, Union So. Africa*, 3-4 (1915), pp. 632, figs. 154).—These reports consist of 17 papers by various authors as follows:

Contribution to the Study of Deficiency Disease, With Special Reference to the Lamziekte Problem in South Africa, A. Theiller, H. H. Green, and P. R. Viljoen (pp. 9-68); Sheep Scab.—Observations on the Life History of *Psoroptes communis* var. *ovis*, and Some Points Connected with the Epizootiology of the Disease in South Africa, by A. W. Shilston (pp. 71-98); Experiments and Observations Carried Out with *P. communis* at Onderstepoort, by G. A. H. Bedford (pp. 101-111); The Sulphur Sheep Dips, by H. H. Green (pp. 115-161); Report upon the Dipping Trials Carried Out with the Different Proprietary and Homemade Sheep Dips in South Africa, by G. A. H. Bedford (pp. 165-172); Upon the Composition and Analysis of Polysulphid Solutions (pp. 175-195) and Arsenical Dip Tester (pp. 199-214), both by H. H. Green; Infectious or Pernicious Anemia of Equines in South Africa, by A. Theiller and D. Kehoe (pp. 217-289); Investigations Into the Life History of the Wireworm in Ostriches, by A. Theiller and W. Robertson (pp. 293-345); The Anatomy and Life History of the *Haemonchus contortus*, by F. Veglia (pp. 349-500); Some Observations in Connection with the Immunization of Cattle Against South African Redwater and Genuine Gall Sickness (Anaplasmosis), by J. Walker (pp. 503-526); The Cultivation of *Anaplasma marginale* in vitro, by F. Veglia (pp. 529-532); Aspergillosis in the Ostrich Chick (pp. 535-574), and A Short Note on the Occurrence of *Cytodites nudus* in the Domestic Fowl in South Africa (pp. 577-581) both by J. Walker; Investigations into Jagziekte or Chronic Catarrhal Pneumonia of Sheep, by D. T. Mitchell (pp. 585-614); Report on *Acakanthera venenata*, G. Don, from the Transvaal (pp. 617-623); and On the Transmission of *Haemoproteus columbae*, by R. Gonder (pp. 627-632).

Veterinary work in Argentina, WEHRLE (*Arch. K. Gesundheitsw.*, 50 (1915), No. 2, pp. 164-302).—This paper presents details of veterinary work, statistics relating to domestic animals, etc., for Argentina, continuing the series previously noted (*E. S. R.*, 34, p. 576).

Text-book of meat hygiene, R. EDELMANN, trans. by J. R. MOHLER and A. EICHORN (*Philadelphia: Lea & Febiger*, 1916, 3. rev. ed., pp. VI+17-453, pls. 5, figs. 161).—This is the third revised English edition and authorized translation revised for America (*E. S. R.*, 21, p. 163).

Fumigation of cotton seed by gaseous hydrocyanic acid, F. HUGHES (*Agr. Jour. Egypt*, 5 (1915), No. 1-2, pp. 84-90).—The experiments reported led to the conclusion that "although minute quantities of hydrocyanic acid have been found in all samples of treated seed examined, the amount is so small that no fear need be entertained as to its proving in any way toxic. The acid appears

to be for the most part expelled or destroyed in the process of 'cooking' preparatory to the extraction of the oil.

"The quantity of hydrocyanic acid found in the cake prepared from treated seed is so small that it would in no way interfere with its use as cattle feed. No hydrocyanic acid could be detected in the partly refined oil. No alteration in its character or properties could be detected. The considerable absorption of hydrocyanic acid gas by cotton seed appears to be very largely due to the solubility of the gas in the oil contained in the seed."

The biologic reactions of the vegetable proteins.—VII, Anaphylaxis reactions between proteins from seeds of different genera of plants, H. G. WELLS and T. B. OSBORNE (*Jour. Infect. Diseases*, 19 (1916), No. 2, pp. 183-193).—Continuing work previously noted (*E. S. R.*, 34, p. 577) it is concluded that since chemically similar proteins from seeds of different genera react anaphylactically with one another, while chemically dissimilar proteins from the same seed fail to do so in many cases, the specificity of the anaphylactic reaction depends on the chemical structure of the protein molecule.

Certain nonspecific reactions obtained with antigens made from bacteria grown on serum media, J. K. OLITSKY and E. BERNSTEIN (*Jour. Infect. Diseases*, 19 (1916), No. 2, pp. 253-259).—"The injection of serum-grown bacteria into animals for the purpose of producing immune serum for comparative serologic studies is to be avoided. Such a method results in the production of a precipitating serum *v.* the serum present in the media. The antiserum thus formed reacts in a nonspecific manner to various bacteria grown on serum media in regard to precipitation, agglutination, complement-fixation, and formation of cellular antibody."

A comparison of the natural hemolytic activity of fresh human sera against guinea-pig and sheep erythrocytes, H. W. WADE (*Jour. Med. Research*, 34 (1916), No. 1, pp. 113-119).—From the study it is concluded that natural antiginea-pig hemolytic activity occurs in human sera with considerable regularity and uniformity of concentration. This hemolytic combination is deemed superior to the natural antisheep cell hemolysins as a serological reagent, since the latter appears less constantly and with greater variability of concentration.

The influence of exposure to X-rays upon the formation of antibodies, J. P. SIMONDS and H. M. JONES (*Jour. Med. Research*, 33 (1915), No. 2, pp. 183-196, fig. 1).—In the experiments reported rabbits were exposed daily to X-rays for from 10 to 15 minutes for a period of three weeks. Immediately following the exposure a single large dose of killed typhoid bacilli was given intraperitoneally to each animal.

The exposure to the X-rays was found to lower appreciably the formation of agglutinins. No marked difference was observed in the opsonic content and complement-fixing power of the serum of X-rayed animals compared with controls. It is deemed that the results obtained in a study of the bacteriolysins for typhoid bacilli do not warrant a positive statement. The indications are, however, that the production of bacteriolysins was not greatly interfered with by exposure to X-rays.

The effect of injections of benzol upon the production of antibodies, J. P. SIMONDS and H. M. JONES (*Jour. Med. Research*, 33 (1915), No. 2, pp. 197-211, figs. 2).—In these experiments rabbits were injected subcutaneously with a mixture of 1 part benzol and 2 parts olive oil in such doses that the animals received approximately 1 cc. of benzol per kilogram of body weight.

Sharp individual differences were noted in the effect of the injections upon the leucocytes and erythrocytes of the different animals. A depression in the

production of hemolysins, agglutinins, and opsonins was observed in the injected animals, as compared with normal controls injected with the same antigen. The depression was most marked in the case of hemolysins and least so in the case of opsonins.

On the concentration of antitoxic sera, ANNIE HOMER (*Biochem. Jour.*, 10 (1916), No. 2, pp. 230-307, figs. 3).—The work reported shows that the advantages claimed by Banzhaf^a for the one-fraction process in the concentration of sera are often vitiated by the fact that a final product is obtained which on account of the presence of an opalescent suspension, presumably euglobulin, can not be filtered except after long standing. The successful preparation of an easily filterable end product has been found to depend on the initial heating of the serum mixtures. The heating process does not cause a conversion of pseudoglobulin into euglobulin, but merely serves to complete the aggregation of the euglobulin into particles sufficiently large to admit of separation by filtration.

The uncertainty with regard to the successful heating of the serum mixtures is obviated by the addition of 1.5 per cent sodium chlorid. It is deemed possible that the addition of sodium chlorid exerts a favorable influence on the filtration process by an adjustment of the hydrogen-ion concentration of the serum mixtures.

Observations with regard to the effect of the addition of sodium chlorid to the serum mixtures have also been made and are reported in detail.

A multiple pipette for the complement-fixation test, J. M. BUCK (*Jour. Infect. Diseases*, 19 (1916), No. 2, pp. 267-271, figs. 3).—A pipette by means of which twelve portions of either normal salt solution, complement, sensitized serum, or any of the other elements used in serological diagnosis can be distributed at one time is described, as well as a special container for the substance to be distributed and a modified test-tube rack. The multiple pipette not only permits of indefinitely greater progress with greater accuracy but also eliminates the severe eye strain resulting from the constant reading of the type of pipette generally used.

Hemolytic streptococci found in milk: Their significance and their relation to virulent streptococci of human origin, D. J. DAVIS (*Jour. Infect. Diseases*, 19 (1916), No. 2, pp. 236-252, figs. 2).—The results of the study reported are summarized as follows:

"Hemolytic streptococci, having a wide clear zone, occur commonly in both pasteurized and unpasteurized (certified) milk. These strains vary among themselves. They are more resistant to heat than human strains of hemolytic streptococci, and possess little or no virulence for rabbits, therefore in all probability none for man. They rapidly acidify and coagulate milk, and grow well at 20° C. They form short or long chains, but as seen in milk often appear in pairs or a chain of few elements. While they are definitely hemolytic . . . the characteristics of the hemolytic zone on plates may vary in certain respects.

"The milk strains are different from certain strains of hemolytic streptococci found at times in diseased udders in cows. These latter resemble the strains of hemolytic streptococci from human sources, and are virulent for rabbits.

"There is no reason to consider that these organisms have any sanitary significance. The importance, however, of certain types of hemolytic streptococci in relation to epidemics of sore throat makes it necessary to study carefully all such organisms in milk. By itself the hemolytic property has no more value for identification purposes than many other characteristics, but is greatly important on account of the practical value of the blood-agar-plate method as a

^a Collected Studies Bur. Lab. Dept. Health N. Y. City, 7 (1912-13), pp. 114-118.

means of initial separation of human type strains from the many strains of nonhemolytic and feebly hemolytic streptococci found in milk."

A comparative study of colon bacilli isolated from horse, cow, and man, T. J. MURRAY (*Jour. Infect. Diseases*, 19 (1916), No. 2, pp. 161-174, figs. 2).—From the work reported it is concluded that the different types of strains, human, bovine, and equine, exhibit a remarkable similarity in the reactions tested, chiefly in acid production. In general the average amount of acid produced by each type tended to decrease as the complexity of the tested substance increased.

"With mannite, dextrose, and lactose, the organisms have a high point of acid production at which the larger percentage of the strains belong. The other strains for the greater part lie immediately on either side of this high point. The acid production for the larger number is confined to narrow limits. The high points of acid production do not lie far apart with dextrose, lactose, and mannite. They coincide in the case of mannite. In general with saccharose, raffinose, and salicin this high point is neither clearly shown nor definitely marked. The acid production varies greatly and is spread over a large area."

The mode of infection in pulmonary distomiasis.—Certain fresh water crabs as intermediate hosts of *Paragonimus westermanii*, K. NAKAGAWA (*Jour. Infect. Diseases*, 18 (1916), No. 2, pp. 131-142, pls. 4, figs. 2).—This is the article referred to in the paper previously noted (E. S. R., 35, p. 384).

Investigations of foot-and-mouth disease, IV, E. KALLERT (*Arb. K. Gandhtsaml.*, 50 (1915), No. 2, pp. 159-163, pls. 2).—This fourth contribution (E. S. R., 34, p. 879) deals with the changes which take place in the rumen of cattle affected with foot-and-mouth disease.

Mortality among grazing animals in Germany due to *Simulium* reptans, MATTHISEN, PEETS, and DAHLGRÜN (*Berlin, Tierärztl. Wehnschr.*, 31 (1915), No. 36, pp. 421-425, fig. 1; *abstr. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases*, 6 (1915), No. 11, pp. 1499, 1500).—For ten years a disease has been recorded among grazing animals in the districts of Neustadt-am-Rübenberge and Fallingbostal, located on the low ground near the rivers Aller and Leine, Prussia, which regularly causes the death of a large number of cattle, usually a short time after they are turned out to pasture. Horses are only rarely attacked. Investigations made regarding the disease show that the death of the animals is due to the bite of *S. reptans*.

Some observations on the methods of using the agglutination test in the diagnosis of disease in bovines caused by the bacillus of contagious abortion, H. R. SEDDON (*Proc. Roy. Soc. Victoria, n. ser.*, 27 (1915), No. 2, pp. 370-390).—The author discusses the study reported under the topics of materials required on which to found a diagnosis of contagious abortion, technique employed, and quantitative factors in the agglutination reaction.

In determining whether the relation of the quantity of pure serum to the degree of dilution or the amount of pure serum in the tube is the determining factor in agglutination of a particular serum, it is concluded that "tubes possessing the same dilution (but different quantities) of serum do not furnish parallel results. . . . Tubes containing the same quantity of serum do furnish parallel results. The agglutination titer varies with the quantity of emulsion used." The dominating factor on an agglutination system is, therefore, the quantity of serum in each tube, and not the degree of dilution.

Studies on the optimum amount of emulsion for use in the test are also reported.

Different types of streptococci and their relation to bovine mastitis, G. MATHERS (*Jour. Infect. Diseases*, 19 (1916), No. 2, pp. 222-235).—The author has corroborated the findings of Davis and Capps (E. S. R., 31, p. 482) that

hemolytic streptococci of human origin produce mastitis in cows when injected directly into the milk ducts.

"This mastitis may be severe, leading to a caked bag and later to a chronic inflammatory condition which results in an atrophy of the mammary gland. On the other hand, virulent hemolytic streptococci may grow and multiply in the milk ducts of a cow without causing any visible changes in the udder. The milk, however, . . . contains hemolytic streptococci and an increased number of leucocytes. These infections may persist over long periods of time in the form of a chronic mastitis.

"*Streptococcus lacticus* of the type used in these experiments produces a very acute inflammation of the udder when cultures are injected directly into the milk ducts. This infection . . . was of short duration and left the gland functionally unchanged. A nonpathogenic hemolytic streptococcus of the type commonly found in normal milk may give rise to a transitory inflammation of the udder when injected directly into the milk ducts, producing a mastitis similar in every detail to that produced by nonhemolytic *S. lacticus*. The presence of pathogenic streptococci and an increased number of leucocytes in milk is indicative of a mastitis, and may be the sole indication of mastitis.

"The quarters of a cow's udder under experimental conditions are apparently separate as regards infection. One quarter may be infected, while the others remain normal. Examination of the milk from each quarter of the udder is necessary before mastitis can be excluded in a suspected cow.

"In three instances of bovine mastitis, all of which were due to hemolytic streptococci with all the characteristics of the human types, no noteworthy changes in the morphology or cultural characteristics of the invading organisms were observed in frequent examinations of the milk throughout the course of the infections. The distinguishing characteristics primarily noted for each organism were still present at the last observation, and there were no modifications which might be considered as indicating a change from one type to the other. The cultural and morphological characters of *S. lacticus* and of the hemolytic streptococcus derived from normal milk did not change during the course of the udder infections which they induced."

Control and eradication of infectious mastitis in dairy herds, H. MOAX (*Cornell Vet.*, 6 (1916), No. 1, pp. 36-40).—Considerable success has been met with in the control of this disease by dipping the teats after milking in a weak solution of one of the newer high-powered antiseptics, pyxol, wescol, or hycol (one teaspoonful to 3 pints or 2 qt. of water), for six or seven seconds. Reports from several herds affected with mastitis state that from the time this treatment was started no new cases developed. The practice is now made obligatory on 12 farms furnishing certified milk for Brooklyn, N. Y.

Effects of feeding cotton seed and its products to swine, G. A. ROBERTS (*Jour. Amer. Vet. Med. Assoc.*, 49 (1916), No. 1, pp. 12-17).—A digest of investigational work of the several divisions of the North Carolina Experiment Station during the past six years.

"While several agents [sulphate of iron, ashes, etc.] have proved efficient in prolonging the period of safe feeding of cotton-seed meal no practical means for eliminating the toxic element, or elements, has as yet been developed. The writer believes that the effect of the above agents is purely chemical in rendering the gossypol, and possibly other toxic substances, nontoxic. He has noted with others that hogs having range and rooting a great deal apparently gain minerals from the soil and forage which enable them to withstand the cotton-seed meal longer than when confined, especially when on a board floor. Since iron salts did not prevent all deaths, and that a number of iron-fed swine developed conspicuous rheumatic symptoms, the writer does not believe iron to be

the logical antidote, but has hopes that a safe method of feeding the meal to swine will be discovered." See also a previous note (E. S. R., 34, p. 79).

Feeding experiments with *Bacterium pullorum*.—The toxicity of infected eggs, L. F. RETTGER, T. G. HULL, and W. S. STURGES (*Jour. Expt. Med.*, 23 (1916), No. 4, pp. 475-489).—"The problem of eradicating ovarian infection in the domestic fowl assumes still greater importance than heretofore in the light of data recently acquired. Not only is it of great significance to eliminate the permanent carriers of *B. pullorum* from all flocks of fowls from the standpoint of successful poultry breeding, but also because they constitute a possible source of danger to man.

"Eggs which harbor *B. pullorum* in the yolk in large numbers may produce abnormal conditions, when fed, not only in young chicks but in adult fowls, young rabbits, guinea pigs, and kittens. The toxicity for young rabbits is most pronounced, the infection usually resulting in the death of the animals. In kittens the most prominent symptoms are those of severe food poisoning with members of the paratyphoid group of bacteria. The possibility of infected eggs causing serious disturbances in young children and in the sick and convalescent of all ages must therefore receive serious consideration.

"Ovarian infection of fowls is very common throughout this country. Hence, a large proportion of the marketed eggs are infected with *B. pullorum*. When such eggs are allowed to remain in nests under broody hens, or in warm storage places, for comparatively few hours, they contain large numbers of the organism.

"Soft boiling, coddling, and frying on one side only do not necessarily render the yolks free from viable bacteria; therefore, eggs which have gone through these processes may, like raw eggs, be the cause of serious disturbances in persons who are particularly susceptible to such influence, and especially to infants."

Morphology of adult and larval cestodes from poultry, J. E. GUTBERLET (*Trans. Amer. Micros. Soc.*, 35 (1916), No. 1, pp. 23-44, pls. 4).—"By morphological comparison of the cysticercoids produced experimentally in flies and adult of *Choanatenia infundibuliformis* they are shown to be identical. Morphological points noted are the presence of minute hooklets on the suckers and entire surface of scolex in *C. infundibuliformis*. The manner of development of uterus in the same species is by means of a blind tube which grows in size, forming pockets, and later breaks up into small compartments. In *Davainea tetragona* the genital pores were found to occur irregularly alternate in the proglottids. The hooks on the rostellum of *D. cesticillus* were found to vary in length from 8 to 12 μ . The uterus in development first appears as a solid cord of cells which becomes hollow and in growing forms pockets, filling the entire proglottid."

The studies here presented relate to those previously noted (E. S. R., 33, p. 577.) A bibliography of 28 titles is appended.

Further investigations into the etiology of the protozoan disease of turkeys known as blackhead, entero-hepatitis, typhlitis, etc., T. SMITH (*Jour. Med. Research*, 33 (1915), No. 2, pp. 243-270, pls. 5).—"Putting together the data at hand, certain facts seem to stand out quite clearly. The parasite, from the fact of its destructive effect on the young bird's life, is poorly adapted to its young host. The process of invasion into the walls of ceca and liver is not adjusted to the discharge of parasites for passage to another host. The parasites are buried within the host lesions. Again, the cycle as observed is obviously incomplete. There is all told a remarkable want of adaptation of means to ends such as we find so fully developed in the coccidia and protozoan blood parasites, for instance.

"The evidence points to several possible theories rather widely divergent. The disease may represent a kind of aberrant parasitism, the true host being some other species. Or the parasite may undergo its normal development in the contents of the ceca, and the invasion of the tissues may be abnormal. Or there may be still other stages and an intermediate host. These views can only be definitely proved or disproved with the aid of the experimental method. The writer does not feel committed to any one of these hypotheses. The results obtained on feeding in 1913 and on exposing young artificially reared turkeys to young diseased turkeys in 1914 were not definite enough to prove that infection is direct from diseased bird to healthy, and they will require repetition and amplification.

"In casting about for a satisfactory method for raising trustworthy birds for experimental work the writer found that healthy turkeys could be reared from infected flocks by using the incubator and brooder. This procedure has made it fairly evident that blackhead is not transmitted in the egg, although more trials are needed before we can be certain of this."

Aberrant intestinal protozoan parasites in the turkey. T. SMITH (*Jour. Expt. Med.*, 23 (1916), No. 3, pp. 293-300, pl. 1).—"There are so many points of difference between the blackhead parasite and the unknown parasite of the mucous membrane as encountered in this single case, that any attempt to present them would require an elaborate restatement of what is now published. Assuming that they are different, we are confronted with the fact that, even after the blackhead parasite shall have been eliminated, the outlook for raising turkeys without some losses due to avian coccidia and perhaps other still unknown protozoan parasites is not very encouraging. Fortunately the mortality due to these aberrant parasites was low. In any case the specific sources of coccidia and other parasites must be found and dealt with."

Hasstilesia tricolor, a common parasite of rabbits in the United States. M. C. HALL (*Jour. Amer. Vet. Med. Assoc.*, 48 (1916), No. 4, pp. 455-456).—"The author erects the genus *Hasstilesia* for *Distoma tricolor* described from *Sylvilagus mollurus* (*Leptus sylvaticus*) and *L. americanus* by Stiles and Hassall in 1894. This is a very common intestinal parasite of rabbits in Maryland, Virginia, and the District of Columbia and is also recorded from New York and Texas.

RURAL ENGINEERING.

Reports on irrigation for the year 1915. E. F. DBAKE and F. H. PETERS (*Dept. Int. Canada Ann. Rpt. 1915*, pt. 7, pp. 23).—"This includes the reports of the superintendent and the commissioner of irrigation of Canada.

Venturi meter succeeds in irrigation. (*Engin. News*, 75 (1916), No. 24, pp. 1122, 1123, figs. 3).—"A description of the adaptation of this well-known device to the measurement of irrigation water is given.

Determination of the maximum storm-water flow. C. E. GRUNSKY (*West. Engin.*, 5 (1914), No. 6, pp. 254-256, fig. 1).—"This is a description of a new method of solving the problem of rate of maximum run-off, involving a discussion of the elements affecting its determination, the derivation of the Grunsky formula for maximum rain intensity, and tabulated data showing its application.

The formula is $I = \frac{C}{\sqrt{t}}$, in which I =intensity in inches per hour, t =time in minutes, and C =a coefficient to be determined from rain records.

Determination of maximum stream flow. C. E. GRUNSKY (*West. Engin.*, 7 (1916), pp. 217-219).—"From the formula for storm-water flow applicable to small areas, noted above, an expression for maximum stream flow is developed.

which it is stated may be applied to even the largest streams. Examples are given based on the actual discharge of several rivers.

Control of the Colorado River as related to the protection of Imperial Valley, J. C. ALLISON (*Proc. Amer. Soc. Civ. Engin.*, 42 (1916), No. 5, pp. 681-709, figs. 10).—The more important details of this work are described.

The drainage of the humid and saline soils of the Egyptian Delta, É. CATZEFELS (*Egypte Contemporaine*, No. 27 (1916), pp. 324-354, pl. 1).—This article deals with the technique and economics of the drainage of the humid and saline soils of Egypt.

The results of physical tests of road-building rock, P. HUBBARO and F. H. JACKSON, JR. (*U. S. Dept. Agr. Bul.* 370 (1916), pp. 100, . 1).—This bulletin and Bulletin 347 (*E. S. R.*, 34, p. 890) together constitute a complete revision of Office of Public Roads Bulletin 44 (*E. S. R.*, 27, p. 587), and furnish the results of physical tests of road-building rock made in the laboratories of the United States Office of Public Roads and Rural Engineering to January 1, 1916. It has been assumed that traffic of less than 100 vehicles per day is light, between 100 and 250 moderate, and over 250 heavy.

"The ideal rock for the construction of a water-bound macadam road resists the wear of traffic . . . to that extent which will supply a sufficient amount of cementitious rock dust to bind the larger fragments in place. . . . As determined by test, cementing values [for rocks] below 25 are called low; from 26 to 75, average; and above 75, high. In general, the cementing value should run above 25. For rocks which show a low French coefficient of wear, a relatively high cementing value is more necessary than for those which have a high French coefficient. . . .

"Experience has shown that in general the following table of limiting values for the French coefficient of wear, toughness, and hardness may be used in determining the suitability of a rock for the construction of the wearing course of a macadam road:

Limiting values of physical tests of rock for water-bound macadam road construction.

Character of traffic.	Limits of tests.		
	French coefficient of wear.	Toughness.	Hardness.
Light.....	5-8 (5-8 per cent wear).....	5-9.....	10-17.
Moderate.....	8-15 (2.7-5 per cent wear).....	10-18.....	Over 14.
Heavy.....	Over 15 (less than 2.7 per cent wear).....	Over 18...	Over 17.

"As a result of comparing hardness and toughness tests of some 3,000 samples, . . . when any given value for toughness falls within certain limits which define the suitability of the material for macadam road construction under given traffic conditions, the corresponding value for hardness will fall within similar limits for hardness. . . . The great majority of samples having a French coefficient of wear of from 5 to 8 and a hardness of over 17 are granites, quartzites, and hard sandstones, which are unsuited for use in the wearing course of water-bound macadam roads due to their lack of binding power.

"For broken-stone roads which are maintained with dust palliatives, the same limits for French coefficient of wear and toughness should hold as for ordinary macadam roads. In bituminous work in some cases it is advantageous to use a rock of relatively high absorption rather than one with low absorptive quali-

ties, owing to a better adhesion of the bituminous material by a partial surface impregnation of the rock."

The following table "may be used as a general guide for minimum limits of French coefficient of wear and toughness in connection with bituminous broken-stone roads."

Minimum limits of physical tests of rock for bituminous-road construction.

Type of road.	Light to moderate traffic.		Moderate to heavy traffic.	
	French coefficient of wear.	Toughness.	French coefficient of wear.	Toughness.
Broken stone with bituminous carpet.	5= (not over 8 per cent wear).	5	7= (not over 5.7 per cent wear).	10
Bituminous broken stone with seal coat.				
Bituminous concrete with or without seal coat.	7= (not over 5.7 per cent wear).	7	10= (not over 4 per cent wear).	13

Construction and maintenance of earth roads, L. V. EDWARDS (*State Col. Wash., Dept. Ext. Bul. 20 (1916), pp. 35, figs. 29*).—This bulletin is intended to give some suggestions to road supervisors and others interested in improved roads as to how to construct and maintain earth roads. The subjects dealt with are grading, grades, widths, drainage, and maintenance.

Brick roads, V. M. PEARCE and C. H. MOOREFIELD (*U. S. Dept. Agr. Bul. 373 (1916), pp. 40, pls. 12, figs. 4*).—A revision of Bulletin 246 (*E. S. R., 33, p. 686*).

Rules and regulations of the Secretary of Agriculture for carrying out the Federal Aid Road Act, D. F. HOUSTON (*U. S. Dept. Agr., Office Sec. Circ. 65 (1916), pp. 24*).—The text of the act (*E. S. R., 35, p. 200*), and of the rules and regulations, is given.

Factors of apportionment to States under Federal Aid Road Act appropriation for the fiscal year 1917 (*U. S. Dept. Agr., Office Sec. Circ. 62 (1916), pp. 2*).—This circular presents the factors of apportionment and the amounts apportioned to each State for the fiscal year 1917 under the Federal Aid Road Act.

Fifth, sixth, seventh, and eighth annual reports of the state roads commission [of Maryland] for the years 1912-1915 (*Ann. Rpts. State Roads Com. Md. 5-8 (1912-1915), pp. 175, pls. 22*).—This reports the activities and expenditures of the commission for the years 1912-1915.

Report of the State Highway Department of Washington for the period October 1, 1912, to October 1, 1914, W. R. ROY (*Rpt. State Highway Dept. Wash., 1912-1914, pp. 192, figs. 42*).—This is an outline of the various phases of work undertaken by the Washington Highway Department, together with a survey of highway conditions in the State and practical suggestions and information.

Bridge foundations, W. BURNSIDE (*New York: D. Van Nostrand Co., 1916, pp. VIII+139, figs. 32*).—This book deals with foundations for abutments and piers of bridges crossing rivers or other waters.

"The different kinds of foundations in common use and the methods by which they are placed in position are described. The conditions suited to each kind are noted and where necessary and possible the principles of design are indicated. Next to nothing, however, is said with regard to cost and in reference to plant."

The subject matter includes chapters on the foundation bed, abutment foundations, pier foundations, piled foundations, dams, screw piles and screw

cylinders, well foundations, standard caissons, open caissons, pneumatic caissons, and the effects of compressed air.

Tables giving data on loads on foundations, skin friction, properties of materials, pile-bearing formula, steel sheet piling, quantities and cost for the pier of the American River bridge, decompression periods, and stage decompression are appended.

Economy in bridge design and construction, H. W. JOYCE (*Calcutta: Bengal Secretariat Book Depot, 1915, pp. [IV]+98, pl. 1, figs. 55*).—This is a series of six lectures on the subject delivered to the students of the Sibpur Engineering College.

Value of the high-pressure steam test of Portland cements, R. J. WIG and H. A. DAVIS (*U. S. Dept. Com., Bur. Standards Technol. Paper 47 (1915), pp. 34, pls. 2, figs. 4; abs. in Sci. Abs., Sect. B—Elect. Engin., 19 (1916), No. 229, p. 127*).—Investigations made to establish "if possible, a relationship between the behavior of Portland cements in high-pressure steam and their physical properties under normal conditions of use and exposure and to determine what value, if any, the high-pressure steam test has as a means of detecting unsoundness which might cause a weakening or disintegration of the cement or concrete" are reported.

"The qualitative high-pressure steam test used consists of subjecting an ordinary soundness pat, which has been stored for 24 hours in a damp closet, to a steam pressure of 300 lbs. per square inch for at least one hour, the total time in the high-pressure boiler being three hours. A cement was said to pass this test when it exhibited no cracking, warping, or disintegration on examination after the treatment.

"The quantitative high-pressure steam test consists of molding six briquettes of neat cement at normal consistency, storing these test pieces 24 hours in a damp closet, then subjecting three of them to an atmosphere of steam at 300 lbs. pressure for at least one hour; the total time in the high-pressure boiler being three hours. The briquettes (both treated and untreated) are then broken in a shot-testing machine. A cement was said to pass this test when the treated briquettes exhibited greater strength than the untreated ones."

The following conclusions are drawn from the results obtained:

"The high-pressure steam test should be made on all cements that are incorporated in cement, mortar, or concrete products that are to be cured in steam at pressures above atmospheric. The high-pressure steam test may be of value as forecasting the behavior of neat cement or a very rich mortar when exposed under normal conditions in dry air, but it will not forecast the behavior of cements in concretes as normally exposed. The cement passing the high-pressure steam test is not superior in cementing quality, as determined from the compressive strength of concretes, to cement that fails to pass this test. The cement passing the high-pressure steam test does not make more permanent or durable concrete than cement which meets the requirements of the standard specification, but fails to pass this test. Cement failing to pass the standard specification atmospheric steam test, but meeting the other requirements of the standard specification shows in some instances a normal strength in concrete. For practical work under normal conditions of construction the results of this investigation fail to show that the high-pressure steam test is of value as a means of determining the ultimate soundness of concrete."

Testing the belt power of a tractor, E. C. GEE (*Power Farming, 25 (1916), No. 6, p. 9, figs. 2*).—This is a brief illustrated description of the prony brake test as applied to a tractor.

Mechanical tillage experiments at Grignon, France, in 1914 and 1915, BRÉTONNIÈRE and RINGELMANN (*Prog. Agr. et Vit. (Ed. l'Est-Centre)*, 36 (1915), No. 23, pp. 532-536; *abs. in Internat. Inst. Agr. [Rome]*, *Mo. Bul. Agr. Intl. and Plant Diseases*, 6 (1915), No. 8, pp. 1093-1095).—Experiments begun in 1913 with a Flemish plow drawn by oxen, a tractor and plow outfit, a motor plow, two rotary cultivators, and two tractor and cable outfits are reported. The soil was a shallow calcareous clay in the first set of experiments. After wheat, a catch crop of white mustard was sown and plowed in by the various machines, one on each plat, while one plat was plowed by a Flemish double "turn-wrist" plow drawn by oxen, after which Grey Houdan oats were sown on all of them. In the second series the soil was fairly deep loam, with oats following lucern. The yields are shown in the following table:

Crop results after mechanical tillage.

Kind of implement.	First series.					Second series.				
	Straw.	Grain.	Chaff, etc.	Total.	Ratio of straw to grain.	Straw.	Grain.	Chaff, etc.	Total.	Ratio of straw to grain.
	Lbs. per acre.	Lbs. per acre.	Lbs. per acre.	Lbs. per acre.		Lbs. per acre.	Lbs. per acre.	Lbs. per acre.	Lbs. per acre.	
Flemish plow drawn by oxen.....	2,750	2,170	491	5,411	127 : 100	3,613	3,256	580	7,449	111 : 100
Tractor and plow.....	3,360	1,948	893	6,111	173 : 100	3,379	3,155	625	7,159	107 : 100
Motor plow.....	3,360	2,409	561	6,489	130 : 100	2,989	2,632	635	6,256	115 : 100
Windlass tractor.....						3,569	3,279	578	7,426	109 : 100
Tractor hauling on cable.....						3,212	2,766	647	6,625	116 : 100
Rotary cultivator (1).....	2,469	1,753	326	4,548	141 : 100	3,345	3,055	647	7,047	120 : 100
Rotary cultivator (2).....	2,542	1,725	491	4,758	147 : 100					

In all the machine-tilled plats in the first series the ratio of straw to grain was greater than in the one plowed by oxen. In the second series the plat plowed by the windlass tractor yielded a crop similar in quantity and ratio of straw to grain to that obtained by the Flemish plow.

In both fields the rotary digger gave lower yields than the Flemish plow, while the results of the tractor and plow and motor plow differed in the two fields. In the first field the crops were heavier than those obtained on the work of the Flemish plow, while in the other field they were inferior. It was also found that in the first field the ground was not too moist and it has been plowed as well by the tractor as by the Flemish plow and decidedly better than by the motor plow. In the tractor-plowed plat the white mustard had been turned in better than by the Flemish plow. On the whole the plats plowed by the tractor and the motor plow were better prepared than the plat worked by oxen. "In the second field, on the other hand, the ground was wet; the work of the tractor left room for criticism while that of the motor plow was quite unsatisfactory."

Dust explosions and fires in grain separators in the Pacific Northwest. D. J. PRICE and E. B. McCORMICK (*U. S. Dept. Agr. Bul.* 379 (1916), pp. 22, pls. 11).—Field and laboratory experiments on the causes of dust explosions in grain separators conducted in cooperation with the University of Idaho and in consultation with the Washington Experiment Station (E. S. R., 32, p. 386) are reported, together with descriptions of preventive devices developed as a result of the investigation.

It was found that explosions were generally distributed among all types of separators, both steel and wood, and that fires occurred also in the combination

type. Of 117 fires 95 were dust explosions, and of 108 fires 82 originated back of the cylinder or very near that point. "About 75 per cent of the occurrences were assigned to the presence of static electricity and to smut explosions. . . . The investigations show conclusively that the presence of a hot box is not essential in order that an explosion may take place. . . .

"As a result of the investigations . . . it is believed that a complete system of electrical connection from all of the moving parts to a common wire, and a thorough grounding of this common wire, will prevent a large percentage of the fires that are due to the presence of static electricity and an explosive mixture of smut dust and air." The use of a suction fan attached to the top of the separator and near the cylinder which exhausts from above the cylinder and from below the fan is also advocated.

An automatic fire extinguisher which was tested and found to be satisfactory is also described. This consists essentially of a tank mounted on top of the separator and containing a bottle of sulphuric acid and water containing soda. Other accessories are a discharge pipe extending throughout the separator and fitted with spray nozzles, a tripping mechanism, and a set of fuses mounted in a wire line.

"The presence of sufficient heat within the separator will melt one of the fuses. This breaks the wire line, releasing the trigger, which frees the tripping mechanism, causing a hammer within the tank to strike a blow sufficient to break the bottle. The discharge of the sulphuric acid into the water containing soda causes the formation of carbon dioxide, which generates sufficient pressure to force the water through the discharge pipe and the nozzles to all the crevices of the separator. . . .

"The locations [of fuses] will vary with each machine, and must be selected so that the fuses are sure to be reached by the flame or the heat, but not so placed that the wire connecting them is likely to be broken by the straw or by the moving parts of the separator.

"The location of the nozzles depends upon the construction of the machine, but the following points should be observed:

"Locate one nozzle directly above the cylinder, if possible; if not, place it so that the beater will help diffuse the spray from that nozzle. Run the pipe line along underneath the roof of the separator, with the nozzles pointing downward. Install a sufficient number of nozzles along this line, and so locate them that every chamber in the separator is thoroughly served by a nozzle. Particular pains should be taken to serve dead air spaces, as it is in these that dust is likely to accumulate. As the stacker end of the machine is less likely to contain any closed chambers, it is probable that, in most types of machines, the nozzles at this end may be 30 in. or more apart. The last nozzle along the pipe line and within the separator should be just above the end of the shakers."

Combination barns for prairie farms. A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 1 (1915), pp. 54, figs. 21*).—This bulletin describes and illustrates the structural details of four combination barns and gives bills of materials.

Dairy barns, ice and milk houses for prairie farms. A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 2 (1915), pp. 66, figs. 20*).—This bulletin describes and illustrates the structural details of four dairy barns and two ice and milk houses.

Beef cattle barns for prairie farms. A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 3 (1915), pp. 53, figs. 18*).—This bulletin describes and diagrammatically illustrates a beef cattle breeding barn, feeding shed, and feeding barn and discusses details of roof framing, mangers, stalls, a portable grain table, and a portable feeder.

Horse barns for prairie farms, A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 4* (1915), pp. 50, figs. 16).—This bulletin describes and illustrates the structural details of four horse barns and discusses the details of roof framing, stalls, and ventilation.

Sheep barns for prairie farms, A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 5* (1915), pp. 34, figs. 13).—This bulletin describes and illustrates the structural details of four sheep barns and of feeding devices and gives bills of materials.

Piggeries and smokehouse for prairie farms, A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 6* (1915), pp. 38, figs. 13).—This bulletin describes and illustrates the structural details of two permanent piggeries, a portable piggery, and a smokehouse, and gives bills of materials.

Poultry houses for prairie farms, A. R. GREIG and R. K. BAKER (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 7* (1915), pp. 35, figs. 12).—This bulletin describes and illustrates the structural details of one permanent and two portable poultry houses, trap nests, feed hoppers, and a coop for a setting hen, and gives bills of materials.

The pullet laying house, G. R. SHOUP (*Washington Sta., West. Wash. Sta. Mo. Bul. 4* (1916), No. 4, pp. 12-20, figs. 2).—This describes the construction of a pullet laying house adapted to Washington conditions.

Commercial poultry house equipment, Mr. and Mrs. G. R. SHOUP (*Washington Sta., West. Wash. Sta. Mo. Bul., 4* (1916), No. 5, pp. 3-11, figs. 4).—This article describes the necessary furnishings and equipment for the efficient handling of laying pullets.

Implement sheds and granaries for prairie farms, A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 8* (1915), pp. 38, figs. 10).—This bulletin describes and illustrates the structural details of a portable granary, two permanent granaries, and two implement sheds, and gives bills of materials.

Silos and root cellars for prairie farms, A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 9* (1915), pp. 38, figs. 17).—This bulletin describes and illustrates the structural details of two stave silos and a root cellar and gives bills of materials.

Silos and silage, H. L. BLANCHARD (*Washington Sta., West. Wash. Sta. Mo. Bul. 4* (1916), No. 4, pp. 2-10, figs. 7).—This is a brief description of the stave, wooden hoop, concrete, and pit silo, and methods of silo filling.

Houses for prairie farms, A. R. GREIG and L. B. BEALE (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 10* (1916), pp. 70, figs. 29).—This bulletin describes and diagrammatically illustrates six farmhouses, gives bills of materials, and discusses septic tanks and methods of laying out farms.

Modern plumbing illustrated, R. M. STARRUCK (*New York: The Norman W. Henley Publishing Co., 1915, 3. ed., rev. and enl., pp. 407, figs. 58; rev. in Engin. News, 75* (1916), No. 24, pp. 1134, 1135).—This book contains 58 figures illustrating the details of different types and methods of plumbing. It is designed to cover the entire field of plumbing as far as possible. "It takes up not only plumbing as practiced in towns and cities under strict plumbing regulations, but plumbing construction under conditions obtaining in country districts, where the problems which arise are often of an entirely different nature, and where there is not in existence any public regulation of sanitary work.

"The subjects considered cover a variety of lines of work, including fixture work in detail, the construction of the drainage and vent systems in detail, and complete plumbing systems of buildings of various kinds. The work is designed essentially to cover subjects pertaining to drainage alone, but it is clear that in

many instances the subject of water supply is closely associated with the drainage problem, and the author has therefore deemed it advisable in several instances to go somewhat into the general subject of water supply. This is especially true of country plumbing systems and of the systems of large city buildings."

Sewage disposal for country homes, F. M. WHITE and E. G. HASTINGS (Wis. Col. Agr. Ext. Serv. Circ. 60 (1916), pp. 15, figs. 12).—This is a popular illustrated discussion of the subject. See also a previous publication from the Wisconsin Station by Ocock and Wright (E. S. R., 28, p. 86).

RURAL ECONOMICS.

Labor requirements of crop production, T. P. COOPER, F. W. PECK, and A. BOSS (*Minnesota Sta. Bul. 157* (1916), pp. 55, figs. 2).—In 1902, cost-of-production studies were started in three counties in Minnesota. Cost data were gathered by personal visits to farms, and 15 farms were selected in each locality which were visited daily by an agent to obtain labor records and weight of feeds and dairy products. These data were collected yearly since that date for 10 years, although the number of farms was reduced to 8 in each locality. As a result of the studies, data were obtained as to the average annual hours of labor required per acre in producing various field crops, as follows:

Average annual hours of labor per acre required in producing field crops, 1902-1912.

Kind of crop	Northfield, Rice County.		Marshall, Lyons County.		Hastad, Norman County.		Average, all farms.	
	Man.	Horse.	Man.	Horse.	Man.	Horse.	Man.	Horse.
Wheat, shock-threshed.....	14.5	28.0	12.2	29.4	10.8	28.2	12.3	29.9
Oats, shock-threshed.....	14.7	28.2	12.2	30.0	11.7	29.6	13.5	28.9
Barley, shock-threshed.....	14.8	27.9	13.3	31.4	11.9	29.5	12.8	29.9
Fall rye, shock-threshed.....	15.0	31.0	15.6	27.0	10.4	27.5	10.3	27.2
Flax, stack-threshed.....	15.0	31.0	15.6	40.2	12.9	32.6	13.7	33.8
Corn, husked.....	30.1	53.6	22.6	51.6	30.9	57.6	26.2	54.2
Fodder corn, cut, shocked, and stacked.....	33.7	54.1	25.0	51.0	33.1	52.8	30.4	52.6
Silage.....	33.7	56.0	.....	.....	31.5	63.5	32.6	59.8
Hay, timothy and clover, first crop.....	12.7	11.8	11.0	13.4	12.6	13.8	12.3	13.0
Hay, timothy and clover, two cuttings.....	21.3	20.3	15.6	23.0	.....	20.7	.....	21.5
Hay, wild.....	9.1	10.0	11.2	13.5	13.5	20.7	12.2	16.9
Timothy, cut for seed.....	.....	6.0	.....	8.5	4.4	6.1	5.1	7.1
Clover, cut for seed.....	10.1	11.3	8.1	13.6	.....	.....	9.2	12.3
Hay, millet.....	18.5	35.3	16.9	39.1	17.3	39.5	17.3	39.1
Temp.....	14.3	27.4	.....	.....	.....	14.3	.....	27.4

In commenting upon the amount of labor required, the authors make the following statement:

"Increased productivity per laborer may be obtained either by extending the farm operations or by increasing the yields per acre. The extensive type of agriculture is based on the distribution of a man's labor over the greatest possible crop acreage, thus obtaining large productivity per labor unit. It is typified by the use of large-capacity machinery and of mechanical power such as steam or gasoline. In this type of agriculture each man performs a maximum of service through the aid of equipment; that is, of capital invested in equipment. . . .

"The gross returns from each unit of labor used in crop-production may increase to the point of maximum yields. . . . Additional labor should be utilized

on crops only to the point where yields give increased net returns. When this point is reached, it is better management to apply this labor to additional acres, and thus obtain a maximum return for the additional units applied, than to apply additional labor to the crop on the same land and obtain merely equal returns. In other words, if the returns for each unit of additional labor on a given acreage do not show increase, the operation should become more extensive."

Data as to the hours of labor required in marketing farm crops and a comparison of shock-threshing v. stack-threshing are also given.

Waste land and wasted land on farms, J. S. BALL (*U. S. Dept. Agr., Farmers' Bul. 745 (1916), pp. 18, figs. 12*).—The author has classified the non-productive farm areas as follows: Land unnecessarily taken up by farm buildings and lots, unnecessary lanes and roads, fence rows, open ditches, headlands, or turning spaces bordering fields and terraces; the part of any public road included in a farm area; land rendered untillable by swamps, rocks, etc.; wood-land not yielding salable products; and uneconomic pasture land.

He discusses these various types in general and with special reference to information obtained in connection with farm management surveys on 1,703 farms, in nine States. Wide variations in the percentage of the total farm acreage occupied by nonproductive areas were found, both between different regions and on individual farms in the same locality.

Size of farm business, O. R. JOHNSON and W. E. FOARD (*Missouri Sta. Bul. 140 (1916), pp. 3-40, figs. 12*).—This bulletin is the second based on data secured in a survey of four townships in the western part of Johnson County (E. S. R., 32, p. 791). Among the conclusions reached by the authors from this study are the following:

"There are several factors which play a part in determining the size and profitableness of the farm business. First in importance in a diversified farming region is the number of acres operated. The larger farms have a more favorable distribution of capital than the smaller farms. They have as large a percentage of tillable ground and less waste land than the small farms. More of the large farm is kept in grass. The large farm is more heavily stocked with live stock other than work stock. One animal unit is kept for each 6.6 acres of crops on the small farm while only 4.8 crop acres are grown for each animal unit on the larger farm.

"The operator of the larger farm is employing his men, horses, and equipment more efficiently than is the man on the smaller farm. . . . The horse on the large farm cares for 21.2 crop acres while on the small farm he has only 7.3 acres to care for. . . .

"The receipts and expenses per acre are practically the same on large and small farms. . . . The large farm seems to be able to get better results from the feeding of cattle and the return from feeding hogs are at least as good. . . .

"The labor income on a certain-sized farm is limited by the capital investment. Some farms are too heavily capitalized and others do not have enough capital invested. The most successful farms in each group have an investment of from \$70 to \$95 per acre. . . .

"The man with a low capital investment per acre is giving so much attention to grain farming that his system does not give him enough productive labor. Where the capital is larger, the farmer is able to keep more live stock and thus secure more regular employment. This influences his labor income to quite an extent."

The farmer's income, E. A. GOLDENWEISER (*U. S. Dept. Agr., Farmers' Bul. 746 (1916), pp. 7, fig. 1*). This study is based upon the data available regarding farmers' incomes in the reports of the Census and the investigations of the Office of Farm Management and the States Relations Service.

From a study of the Census data, dealing with 6,362,000 farmers, the author concludes that the gross income of the farmer is \$1,236 per farm, out of which he pays \$512 in farm expenses, leaving a net earning of \$724 available for family expenses, payments on mortgage, and savings. After deducting interest on the investment at 5 per cent, there is left \$402 as labor income produced by the family.

The investigations of the Office of Farm Management indicate that the average earnings of 4,018 farm families were \$952, of which \$400 represented the value of the house rent, food, and fuel supplied by the farm. The data obtained through the farm management demonstrations of the States Relations Service indicated that the average labor income on 4,400 farms was approximately \$800.

The author commenting on these data states that "the average farm family makes approximately as much for its labor as the average industrial family, but owing to the lower cost of living on the farm and the interest earned by the farm investment, the average farm family occupies a much more secure economic position than does the average city family."

The farmer's income, E. A. GOLDENWEISER (*Amer. Econ. Rev.*, 6 (1916), No. 1, pp. 42-48, fig. 1).—This article includes a large portion of the above data.

Costs and sources of farm-mortgage loans in the United States, C. W. THOMPSON (*U. S. Dept. Agr. Bul.* 384 (1916), pp. 16, pls. 5).—In this publication data are given as to the average interest rate and the average annual commission by States for farm-mortgage loans, and the proportion of the total mortgages in each State distributed according to the rate of interest paid. Data are also given showing the percentage of the total farm mortgages held by life insurance companies and by banks, factors which influence the terms on farm-mortgage loans, the need for improved facilities, and the desirability of State and Federal legislation.

The author summarizes his conclusions as follows:

"Being given a properly organized credit system, it is believed that the farmer who adopts business methods in his farming and thus shows himself worthy of credit will have adequate opportunity to secure it on reasonable terms. The farmers' need in connection with mortgage credit is to obtain investment capital for relatively long periods of time, on suitable terms of repayment, and at the lowest cost consistent with business policy. A properly organized system should supply this need, and, under suitable Federal regulation and control, should protect the farmer against the unreasonable charges now prevailing in many localities."

Some observations on the bulk handling of grain for California, B. H. CROCHERON and C. J. WILLIAMS (*California Sta. Circ.* 152 (1916), pp. 24).—The advantages and disadvantages of handling grain in bulk and in sacks are discussed, and data on the cost of handling grain by these methods are given. The cost of handling sacked grain after harvesting is estimated at \$3.915 per ton as compared with \$2.90 for bulk handling.

Rules and regulations of the Secretary of Agriculture under the United States Cotton Futures Act of August 11, 1916 (*U. S. Dept. Agr., Office Sec. Circ.* 84 (1916), pp. 27).—This circular contains rules and regulations promulgated by the Secretary of Agriculture relative to the United States Cotton Futures Act (*E. S. R.*, 35, p. 307), as well as a copy of the act itself.

Agricultural associations and the war, P. SAGOURIN (*Ann. Sci. Agron.*, 4 ser., 4 (1915), No. 10-12, pp. 382-397).—In this article are discussed the influence of the war upon the French agricultural associations and some of the functions performed by them under war conditions.

Rome's fall reconsidered, V. G. SIMKHAVITCH (*Polit. Sci. Quart.*, 31 (1916), No. 2, pp. 201-243).—In this article the author points out the influence of the agricultural practice and the methods of holding land upon the decline of the Roman Empire.

Monthly crop reports, July and August, 1916, (*U. S. Dept. Agr., Mo. Crop Rpt.*, 2 (1916), Nos. 7, pp. 61-72; 8, pp. 73-84, figs. 8).—These numbers contain the usual data relative to acreage and condition of the principal crops, average prices paid to producers, estimated farm value, the range of prices of agricultural products at important markets, and miscellaneous data.

No. 7.—This contains a statement relative to the amount of commercial fertilizers sold in the cotton States, a special report on honey yields and prospects, and a review of the tobacco situation and the condition of truck crops for canning. In commenting regarding the prices of wool the following statement is made:

"The average price paid to producers of the United States for unwashed wool in the past month was 28.7 cts. per pound, which compares with 23.7, 18.4, 15.6, 13.7, 15.5, and 19.5 cts., respectively, in June of the past 6 years. . . . The average weight of wool per fleece this year is about 6.92 lbs."

No. 8.—Special articles are included on the commercial acreage and production of onions, the acreage in watermelons and cantaloups in 1915 and 1916, receipts and exports of Durum wheat, and the largest yield per acre of various crops produced on single fields or plats in different parts of the United States.

AGRICULTURAL EDUCATION.

School credit for home practice in agriculture, F. E. HEALD (*U. S. Dept. Agr. Bul.* 385 (1916), pp. 27).—The author discusses (1) methods for teachers' use in giving rank for home work in agriculture and applying that rank with proper weight to the general scholarship average of the pupil, and (2) the basis of such rank or credit for the benefit of school officials who desire to introduce home practice in agriculture as an educational feature into rural schools. Supplementary tables of labor requirements and selected club records of boys' and girls' work are included.

Public elementary schools and food supply in war time (*Jour. Rd. Agr. [London]*, 23 (1916), No. 1, pp. 33-40).—This is the text of a memorandum issued by the English Board of Education, upon request of the president of the Board of Agriculture and Fisheries, to local education authorities, school managers, teachers, parents, and others interested in the work of elementary schools, calling attention to the need for maintaining and increasing the supply of home-grown food of all kinds. The memorandum, without giving detailed suggestions for carrying them on, briefly indicates some minor industries and occupations for increasing the food supply which have been or can be taken up in connection with rural and semirural schools, such as gardening, keeping live stock, poultry, rabbits, bees, pigs, and goats, making jam, evaporating and bottling fruits, and the drying of savory herbs in connection with cookery classes, collection of wild fruits, etc., and farm handicraft.

[State-aided vocational agricultural education in 1915] (*Ann. Rpt. Bd. Ed. [Mass.]*, 79 (1916), pp. 185-193, 293-299, 320, 321; *Bul. Bd. Ed. Mass.* No. 54 (1916), pp. 19).—This report is devoted to the present achievements of the two county agricultural high schools in Bristol and Essex Counties, respectively, and the future prospects of this type of school, and to statistical data on the three vocational agricultural schools and 13 agricultural departments in selected high schools, with reference to receipts and expenditures, teachers, student enrollment, distribution of graduates, activities, including judging and

other contests, earnings of agricultural pupils from farm and other work for the years 1912-1915, inclusive, and project work.

Short courses (*Agr. Gaz. Canada*, 3 (1916), No. 4, pp. 310-324, figs. 4).—This is a review of the short courses in agriculture and home economics offered in the Provinces of Prince Edward Island, Nova Scotia, Quebec, Manitoba, and Saskatchewan.

School garden plans for 1916 (*Agr. Gaz. Canada*, 3 (1916), No. 4, pp. 355-361).—The plans for school garden work for 1916 in the Provinces of Prince Edward Island, Nova Scotia, Ontario, Manitoba, Saskatchewan, and British Columbia, are outlined.

A school garden organization, F. W. BATES (*Agr. Gaz. Canada*, 3 (1916), No. 5, pp. 459-462, figs. 4).—A sketch of the organization and development of the work of the Lost River Municipal School Garden Association in Saskatchewan as an illustration of the success of school gardening organized as a community project.

Report of the Minister of Agriculture, Industry, and Commerce for 1914, M. F. DE QUEIROZ VIEIRA (*Relat. Min. Agr. Indus. e Com., Brazil*, No. 1 (1914), pp. XXXIV+204, pls. 41).—This report includes an account of the progress in 1914 of agricultural education and research institutions in Brazil, comprising the Higher School of Agriculture and Veterinary Medicine at Rio de Janeiro, a secondary or theoretical-practical school of agriculture, 8 agricultural apprentice schools, 1 permanent dairy school, 5 experiment stations, of which 2 are in process of organization; 5 demonstration fields, 2 sericultural stations, 3 zootechnical stations, 4 model stock-breeding farms, and the botanical garden, national museum, and forest nursery, and of agricultural extension work.

The Danish people's high school including a general account of the educational system of Denmark, M. HEGLAND (*U. S. Bur. Ed. Bul.* 45 (1915), pp. 182).—Part I of this bulletin gives a general account of the educational system of Denmark. Part II deals with the origin, growth, life, aims, curricula, methods, influence, and results of the people's high schools in Denmark, gives brief accounts of similar schools in Norway, Sweden, Finland, Germany, England, and the United States, and discusses the adaptation of these schools to American conditions. Tables, giving statistics of students, teachers, and number of hours of instruction devoted to each subject in a five months' course in the people's high schools and agricultural schools in Denmark, and a bibliography are appended.

Activities of the Italian Colonial Agricultural Institute, G. B. GIOLI (*Agr. Colon [Italy]*, 10 (1916), No. 1-2, pp. 94-104).—This is a report, by the director, on the regulations, staff, curriculum, experimental work, and finances for 1914-15 of the Italian Colonial Agricultural Institute at Florence.

The Bavarian forestry schools, ESSLINGER (*Ztschr. Forst. u. Jagdw.*, 47 (1915), No. 9, pp. 568-572).—The author discusses the training required for admission to the forest management and forest protection service, including the new regulations requiring a four-year course in a forest school after the completion of the seven-year Bavarian public school course.

Regulations for the training of teachers of agricultural home economics (*Min. Bl. K. Preuss. Verwalt. Landw., Domänen u. Forsten*, 10 (1914), No. 5, pp. 80-109).—Detailed information is given concerning the training of agricultural housekeeping teachers in Prussia, including (1) the admission requirements; (2) an outline of the one-year course of instruction in cooking, baking, preserving, housekeeping, laundering, sewing, physics, chemistry, botany, the origin, nutritive and economic value, utilization, and adulteration of foodstuffs, marketing, hygiene and sanitation, psychology and pedagogy, civics and rural welfare, household accounts and bookkeeping, animal husbandry, including pig

raising, dairying, poultry raising, and fruit, flower and vegetable gardening; (3) time schedules showing the distribution of subjects and time devoted to theoretical and practical instruction in each; (4) exercises in cooking, baking, and preserving; and (5) written and theoretical-practical oral examination requirements, the former including two theses on methods of teaching and agricultural and home economics subjects, respectively. This training is given in the agricultural seminars of six of the farm and home management schools designated by the Minister of Agriculture, Domains, and Forests, viz, at Obernkirchen, Muidburg, Bad Weilbach near Flörsheim, Mallinckrodtshof at Paderborn, and Luisenhof at Bärwalde.

Scientific informations (*Netherlands East Indian San Francisco Com., Dept. Agr., Indus. and Com., Essay No. 8 (1914), pp. 91, pls. 18*).—Part 1 of this pamphlet gives a history of the Department of Agriculture, Industry, and Commerce of Netherlands East India, and an account of its present organization and work. Part 2 deals with the history and work of private experimental stations, the cost of which is borne privately but which nevertheless form a part of the agricultural department or are in some way connected with it.

MISCELLANEOUS.

Annual Report of Iowa Station, 1915 (*Iowa Sta. Rpt. 1915, pp. 22*).—This contains the organization list and a report by the director and vice director on the work of the station, including a financial statement for the fiscal year ended June 30, 1915.

Twenty-ninth Annual Report of Nebraska Station, 1915 (*Nebraska Sta. Rpt. 1915, pp. XXXVII, figs. 6*).—This contains the organization list, a report as to the work and publications of the year, a report of the extension service of the college of agriculture, and a financial statement for the period ended June 30, 1915. Data as to animal husbandry and dairying are abstracted elsewhere in this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta. West. Wash. Sta. Mo. Bul., 4 (1916), Nos. 4, pp. 20, figs. 10; 5, pp. 16, figs. 4*).—These numbers contain brief articles on the following subjects:

No. 4.—Silos and Silage, by H. L. Blanchard (see p. 690); Summer Pruning, by J. L. Stahl; and The Pullet Laying House, by G. R. Shoup (see p. 690).

No. 5.—Market for Mole Skins, by W. A. Linklater; Commercial Poultry House Equipment, by Mr. and Mrs. G. R. Shoup (see p. 690); Rye in Western Washington, by E. B. Stookey; Black Spot Canker on the Pear, by A. Frank; Select Plants for Potato Seed, by J. L. Stahl; and Molting, by Mrs. G. R. Shoup.

Successful farming, F. D. GARDNER (*Philadelphia: J. C. Winston Co., 1916, pp. 1088, pls. 9, figs. 452*).—This treatise is termed "a ready reference on all phases of agriculture for farmers of the United States and Canada." It is divided into ten main parts, viz, soils and soil management; farm crops; horticulture, forestry, and floriculture; live stock farming (animal husbandry); dairy farming (dairy husbandry); farm buildings and equipment; farm management; plant and animal diseases, insect enemies and their control; home economics and agricultural education; and tables of weights, measures, and agricultural statistics. Many of the chapters are contributed by members of the instruction staff of the Pennsylvania College and other institutions.

The autobiography of a farm boy, I. P. ROBERTS (*Albany, N. Y.: J. B. Lyon Co., 1916, pp. IV+331, pls. 7*).—This autobiography gives considerable space to the author's work at the Iowa College and Cornell University, including graphic accounts of some of the conditions and difficulties encountered in organizing agricultural instruction and research in the pioneer days at these institutions. The introduction is by Dr. L. H. Bailey.

NOTES.

Connecticut College and Stations.—W. M. Esten, who has previously served on both the college and Storrs Station staffs as bacteriologist, has been transferred wholly to college work. Miss C. J. Mason, assistant bacteriologist in the station, has also been transferred to college work. Miss E. B. Whittlesey, herbarium assistant of the State Station, resigned October 1.

Georgia College and Station.—In the college, Dr. L. M. Roderick, instructor in veterinary medicine, resigned August 1, and F. H. Denniss, cooperative field agent in dairying, on October 15. I. W. Arthur has been appointed instructor in animal husbandry, effective September 1, and W. C. Burkhart, D. V. M., instructor in veterinary medicine, effective October 15.

C. A. Wells has resigned as chemist in the station, effective November 1.

Purdue University and Station.—P. R. Edgerton, W. R. Palmer, and O. H. Anderson have resigned, the first named to become a county agent in Illinois, and the remainder to take positions as farm managers. S. P. Smyth has resigned as instructor in poultry husbandry. R. S. Thomas has been appointed assistant in soils and W. R. M. Scott as assistant in farm crops. C. D. Kinsman has been transferred to extension work in rural engineering and C. C. Cunningham has been appointed in charge of drainage work. H. W. Gregory, assistant in dairying in the South Dakota College, has been appointed assistant in dairying. F. H. Beach has been transferred to extension work in horticulture and W. H. Stevenson and F. J. Sutton have been appointed instructors in that subject. H. C. Paine, D. V. M., has been appointed instructor in veterinary science and associate veterinarian in the station and will have charge of the testing of commercial serums.

Maryland Station.—Soil investigations under a special state appropriation have been begun, with A. G. McCall in charge, P. E. Richards as laboratory assistant, and S. W. Phillips as field assistant. R. L. Hill, Ph. D., has been appointed biochemist in dairy research.

Minnesota Station.—The station has recently adopted the policy of regarding all research assistants who devote at least one-half time to work on station projects as members of the staff. Under this plan the following additions to the staff were made at the opening of the present fiscal year: A. M. Gurjar, S. Sato, R. A. Thuma, and A. J. Wuertz, in agricultural biochemistry; J. C. Gillilan and Frank Robotka, in agricultural economics; M. N. Levine, in bacteriological investigations; Samuel Graham and S. Marcovitch, in entomology; A. W. Aamodt, in horticulture; G. R. Hoerner, in plant pathology; and A. L. Anderson, in veterinary science.

G. R. Bisbee has been appointed assistant plant pathologist, R. P. Ingram and Fern Pack, assistant seed analysts, and L. J. Hood, assistant editor, these dating from August 1.

Missouri University and Station.—J. O. Rankin has resigned as agricultural editor to become associate professor of agricultural economics at the Iowa College, and was succeeded November 1 by M. N. Beeler, agricultural editor at the University of Florida. A. R. Evans, instructor in farm crops, has resigned

to accept a position in the Office of Markets and Rural Organization of the U. S. Department of Agriculture.

Montana College and Station.—The chemical building was burned October 20. All the records, the chemistry library, and considerable apparatus were saved. D. S. Fox, Ph. D., has been appointed assistant professor of farm management.

New Jersey College and Station.—An international egg-laying and breeding contest is being conducted under the auspices of the stations at Vineland, N. J., beginning November 1 and continuing for three years. The contest is open to all poultrymen. One of the purposes in view is to throw light on some of the principles of breeding in fowls, especially of the inheritance of fecundity and other characteristics.

Work is being begun on a greenhouse for the department of plant pathology.

S. A. Waksman, H. E. Carney, and Charles H. Richardson have resigned, the first named to accept a fellowship in the University of California, the second to become instructor in the biological sciences and agriculture in the Middletown Township High School, and the third to become assistant in biological chemistry at Columbia University. Recent appointments include Alvah Peterson, Ph. D., as instructor in entomology and assistant entomologist; Miss Nevada S. Evans, as assistant seed analyst; James W. Day, as assistant in agronomy; Joseph R. Neller, as research assistant in soils; and Thurlow C. Nelson in charge of oyster research.

North Carolina College and Station.—The Annual Farmers' Convention held at the college August 29-31, under the auspices of the college, station, and extension workers, was one of the most successful meetings of its kind yet held in the State. About 3,000 men and 2,000 women were in attendance. The special subject of the meeting was rural education, which was graphically presented by means of an exhibition in which several booths were grouped around a larger booth in one of the college buildings. The smaller booths represented the activities of the station and extension service, while the larger booth represented a consolidated or farm-life school. This exhibit attracted much attention from visitors.

E. A. Hodson, assistant professor of agronomy, has been given a year's leave of absence for graduate study, and his work is being taken by J. O. Ware, formerly agent for Columbus County. H. L. Joslyn, assistant professor of soils, has resigned to become superintendent of the Craven County Farm-life School and has been succeeded by T. H. Stafford. George H. Rea has been appointed specialist in bee keeping under a cooperative arrangement between the Bureau of Entomology of the U. S. Department of Agriculture and the extension service. D. G. Sullins has been appointed assistant in animal husbandry and dairying, J. H. Hall, assistant in plant breeding, vice Buxton White, resigned to become alumni secretary for the college, and C. C. Logan, extension specialist in soils.

Oregon College and Station.—The forestry building has been completed. A new swine feeding barn and laboratory is under construction and is expected to be ready for use in November.

Paul H. Crouter, a 1916 graduate, has been appointed superintendent of the Eastern Oregon substation at Union, and will have special charge of the cattle feeding experiments. D. E. Rickard, a member of the same class, has been appointed superintendent of the college live-stock farms, and Carey Lloyd Strome, a third member, has been selected as foreman of the seed crop farms. H. A. Schoth has accepted a position in vetch experiments in connection with the studies of the U. S. Department of Agriculture which are under way at the college.

Pennsylvania College and Station.—M. G. Kains, professor of horticulture and horticulturist, resigned October 1 and has been succeeded by Dr. S. W. Fletcher, formerly director of the Virginia Station. Earle L. Moffitt has been appointed assistant professor of farm management extension, effective November 13. A. B. Long, G. J. Kuhlman, and F. J. Holben have resigned as assistant chemists. R. H. Olmstead, a graduate of the college, has been appointed assistant in animal husbandry; H. Clyde Kandel, instructor in poultry husbandry extension; Albert F. Yeager and John S. Gardner, instructors in horticulture; and C. H. Hadley, jr., instructor in entomology extension.

Utah College and Station.—E. P. Taylor, professor of horticulture and horticulturist, has resigned to become director of agricultural extension at the University of Arizona. E. W. Stephens has been appointed assistant state leader of club work and will have charge of boys' clubs in the high schools. D. W. Pittman has accepted an appointment as instructor in agronomy and assistant agronomist.

Wisconsin University.—A. C. Baer, instructor in dairy husbandry, has resigned to become head of the dairy department of the Oklahoma College and Station.

Necrology.—Prof. Cleveland Abbe, widely known for his eminent services in meteorology in the Weather Bureau of the U. S. Department of Agriculture, died October 28 at the age of 78 years.

Professor Abbe was a native of New York City and educated at the College of the City of New York and Harvard University. He became assistant professor of engineering in the Michigan Agricultural College in 1859, and subsequently instructor in mathematics and astronomy at the University of Michigan. During the most of the Civil War he was a member of the U. S. Coast and Geodetic Survey, and from 1864 to 1866 a guest at the Nicholas Central Observatory near St. Petersburg, Russia.

On returning to this country he was appointed director of the Cincinnati Astronomical Observatory and in 1868 volunteered to make daily predictions of the weather for the benefit of the community. In September, 1869, he began the publication of a daily bulletin of weather probabilities based upon telegraphic reports from observers at a number of points. These forecasts soon attracted widespread attention.

A national bureau of storm warnings was established in 1870 under the direction of the Signal Service of the Army, and in the following year Professor Abbe became a scientific assistant in that work. During the long period of evolution of the U. S. Weather Bureau he was a prominent figure, editing the *Monthly Weather Review* in 1873 and again from 1892 to 1909, and the *Bulletin of the Mount Weather Observatory* during its entire period of publication. He was also the author of an extensive list of meteorological articles and several treatises.

Professor Abbe was a member of the National Academy of Sciences and of many other scientific organizations. He received in 1912 the Symons Memorial Gold Medal of the Royal Meteorological Society of England and recently the Marcellus Hartley Memorial Medal from the National Academy of Sciences, as well as the degree of LL. D. from the University of Michigan in 1888 and the University of Glasgow in 1896.

New Journals.—*Better Business*, a quarterly journal of agricultural and industrial cooperation, is being published by the staff of the Cooperative Reference Library of Dublin, Ireland. The initial number contains articles on the outlook for cooperators, the economics of continuous cropping, a translation of a report of the German Parliamentary Committee appointed to consider the ques-

tion of food supplies in war time, the development of the agricultural cooperative movement in England and Wales, reviews of the current literature on cooperation and related topics, etc.

Part 1 of Volume 1 of *Ectoparasites* has been issued and it is announced that succeeding parts will appear at irregular intervals. It is being edited by Dr. K. Jordan and N. Charles Rothschild. The initial part contains the following articles: On Some Siphonaptera Collected by W. Rückbeil in East Turkestan, by K. Jordan and N. C. Rothschild; Further Notes on *Siphonaptera fracticipita*, with Descriptions of New Genera and Species, by N. C. Rothschild; On Neopsylla and Some Allied Genera of Siphonaptera, by N. C. Rothschild; and Contribution to Our Knowledge of American Siphonaptera, by K. Jordan and N. C. Rothschild.

The State Plant Board of Florida has begun the publication of a *Quarterly Bulletin* devoted to applied entomology and plant pathology in general, with special reference to the prevention, control, and eradication of injurious insects and plant diseases in Florida. The initial number deals with citrus canker investigations.

The initial number of *Archivos do Jardim Botânico do Rio Janeiro* has recently been received. It contains three articles dealing with the flora of the region, and includes meteorological observations at the Garden in 1914.

Revista de la Sociedad de Medicina Veterinaria is being published by the Society of Veterinary Medicine of Buenos Aires. It is devoted mainly to original articles, bibliographical notes, the proceedings of the society, etc.

The Agricultural Journal is being published monthly by the department of agriculture of British Columbia, for the systematic dissemination of agricultural information.

Miscellaneous.—The Philippine Government has made available funds for the establishment of a permanent tobacco experiment station in the upper Cagayan Valley. The station is to be administered by the Bureau of Agriculture, with the Bureau of Internal Revenue and the College of Agriculture of the Philippines contributing advice and other assistance. D. B. Paguirigan and Alfonso B. Cagurangan will be members of the staff.

At the last commencement of the University of the Philippines, the degree of Bachelor of Agriculture was conferred on nine candidates, that of B. S. in Agriculture on one candidate, and that of M. S. on two candidates.

A four-story annex to the Oka Agricultural Institute, Quebec, 160 by 63 feet, has been completed. This will be utilized mainly as a dormitory, but also contains classrooms for zootechny and field crops.

E. D. Ball, formerly director of the Utah Station, has been made state entomologist of Wisconsin, vice J. G. Saunders resigned to succeed H. A. Surface as economic zoologist of Pennsylvania.

According to a note in *Science*, C. B. Williams has been appointed to study the parasites of the sugar-cane frog-hopper in Trinidad.

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